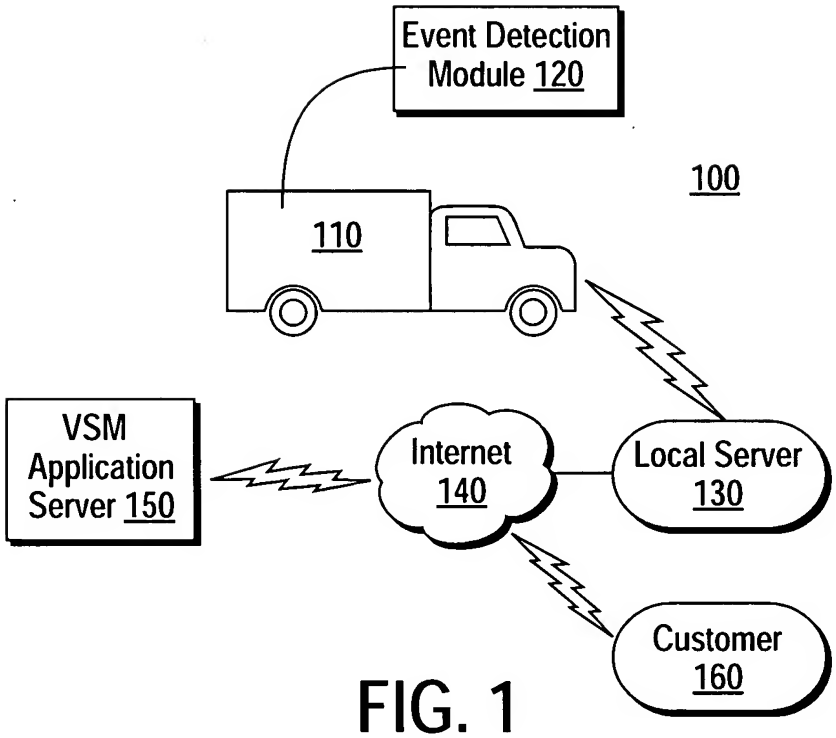

Event Detection Module 120
100
110
VSM Application Server 150
Internet 140
Local Server 130
Customer 160

FIG. 1

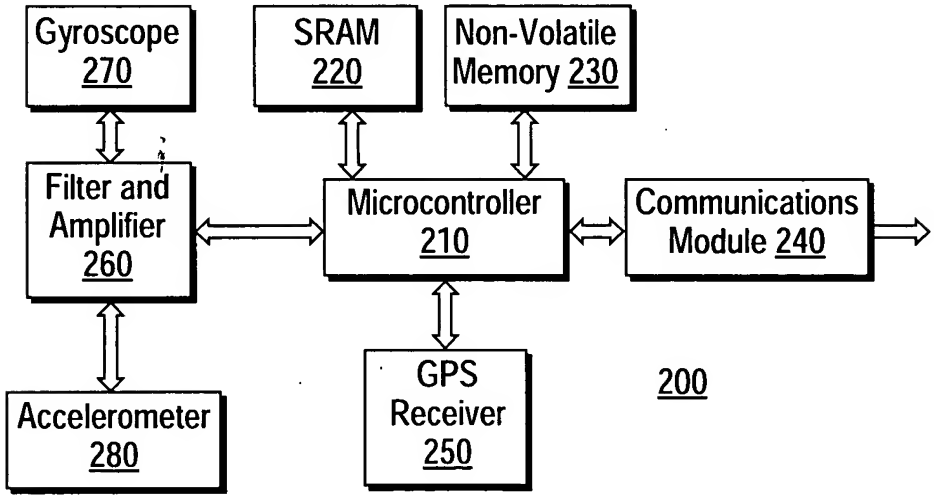

Gyroscope 270
SRAM 220
Non-Volatile Memory 230
Filter and Amplifier 260
Microcontroller 210
Communications Module 240
Accelerometer 280
GPS Receiver 250
200

FIG. 2

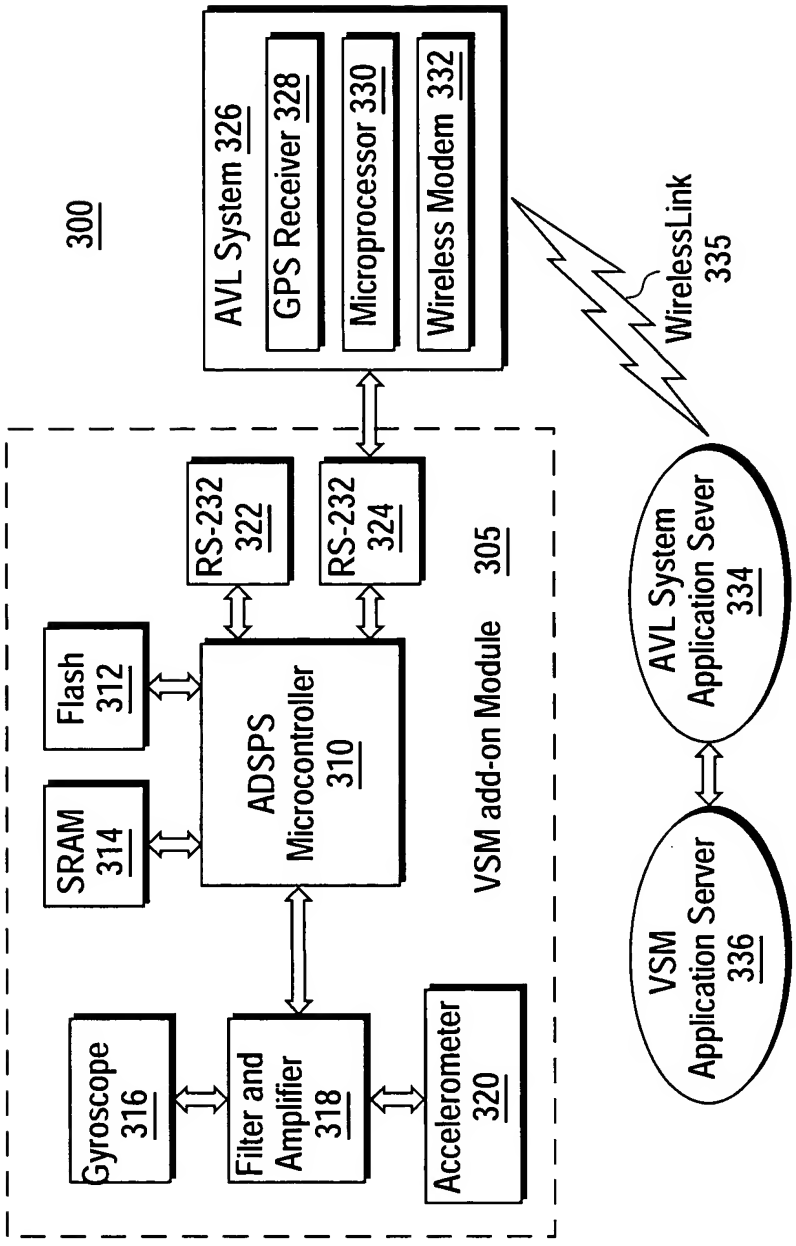

300
AVL System 326
GPS Receiver 328
Microprocessor 330
Wireless Modem 332
WirelessLink 335
RS-232 322
RS-232 324
Flash 312
SRAM 314
ADSPS Microcontroller 310
VSM add-on Module 305
Gyroscope 316
Filter and Amplifier 318
Accelerometer 320
AVL System Application Sever 334
VSM Application Server 336

FIG. 3A

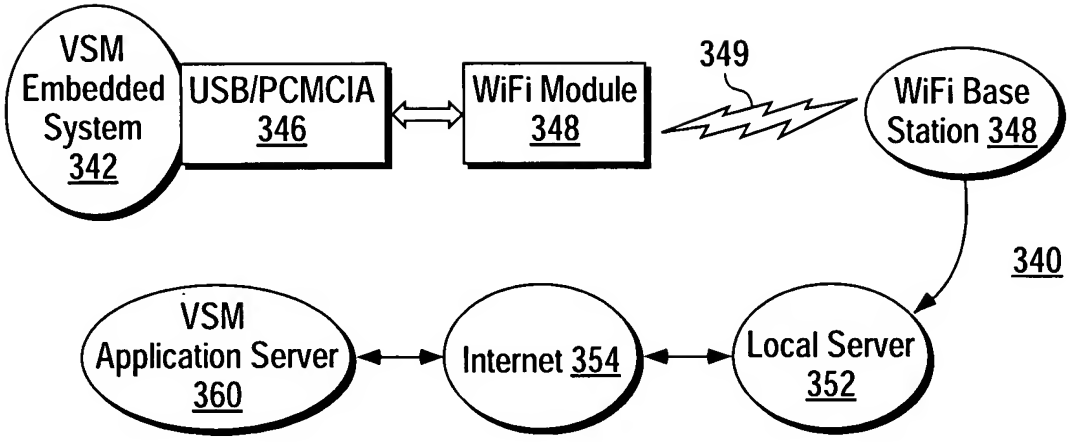

VSM
Embedded
System
342
USB/PCMCIA
346
WiFi Module
348
349
WiFi Base
Station 348
340
VSM
Application Server
360
Internet 354
Local Server
352

FIG. 3B

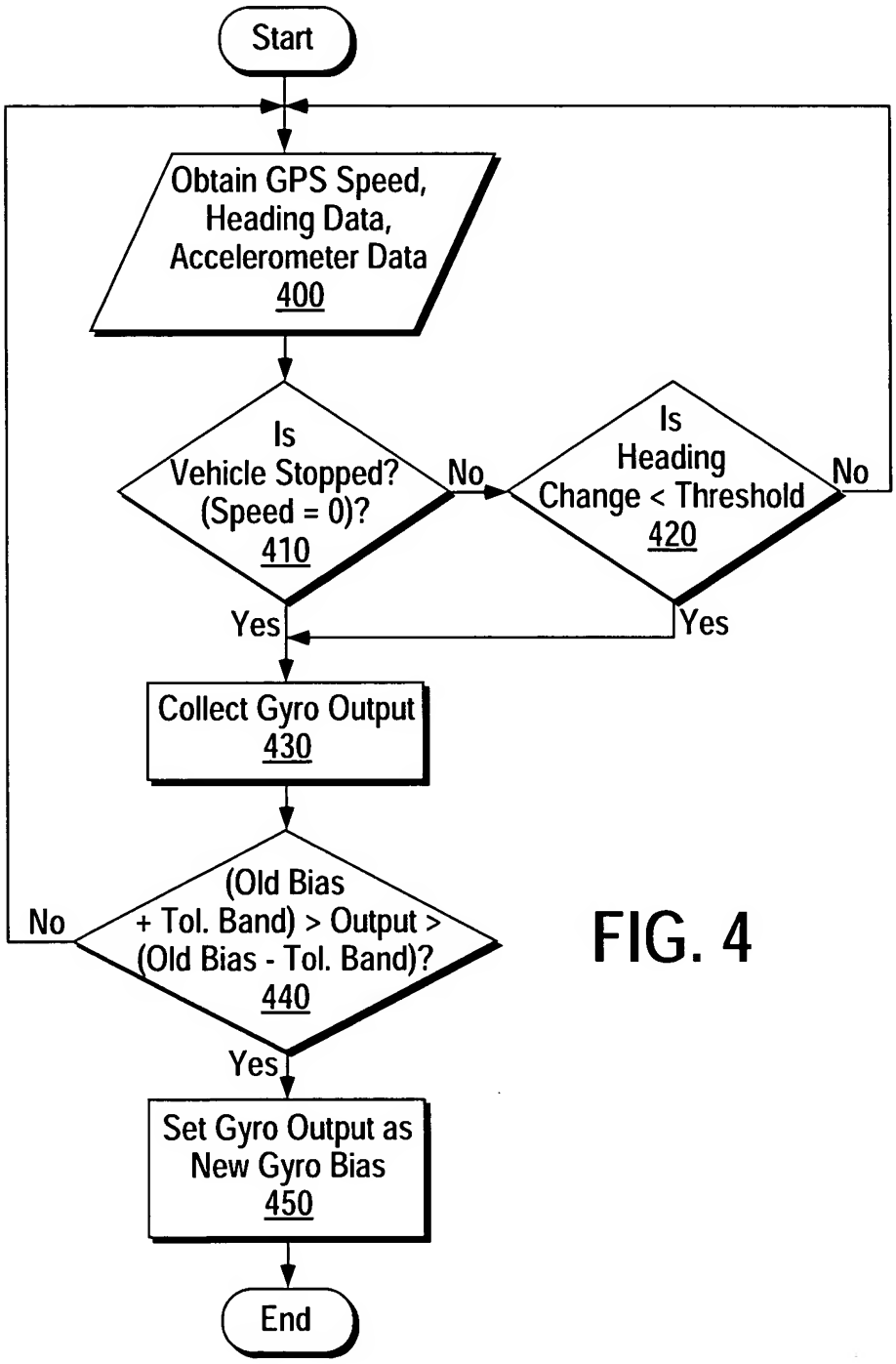

Start
Obtain GPS Speed, Heading Data, Accelerometer Data 400
Is Vehicle Stopped? (Speed = 0)? 410
No
Is Heading Change < Threshold 420
No
Yes
Yes
Collect Gyro Output 430
(Old Bias + Tol. Band) > Output > (Old Bias - Tol. Band)? 440
No
Yes
Set Gyro Output as New Gyro Bias 450
End

FIG. 4

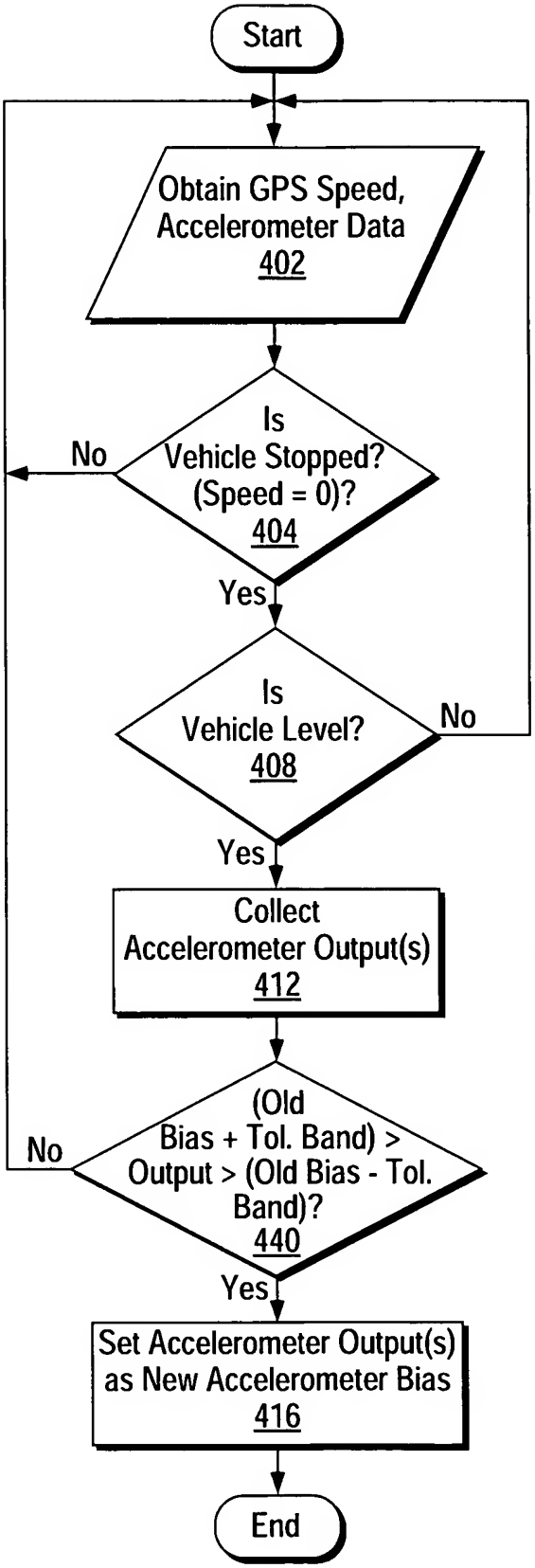

Start
Obtain GPS Speed, Accelerometer Data
402
Is Vehicle Stopped? (Speed = 0)?
404
No
Yes
Is Vehicle Level?
408
No
Yes
Collect Accelerometer Output(s)
412
(Old Bias + Tol. Band) > Output > (Old Bias - Tol. Band)?
440
No
Yes
Set Accelerometer Output(s) as New Accelerometer Bias
416
End

FIG. 5

FIG. 6A

FIG. 6
FIG. 6A
FIG. 6B

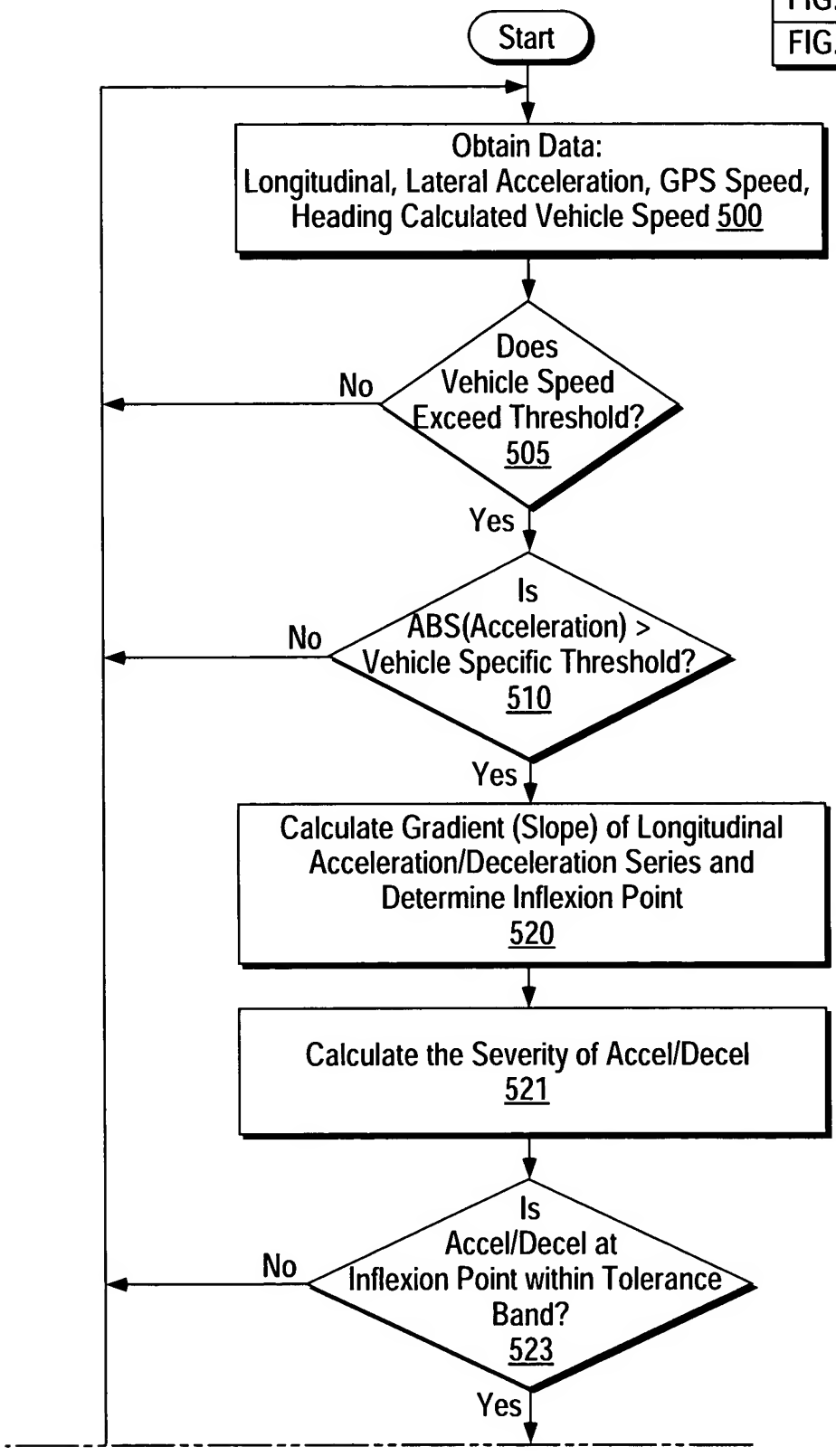


FIG. 6B

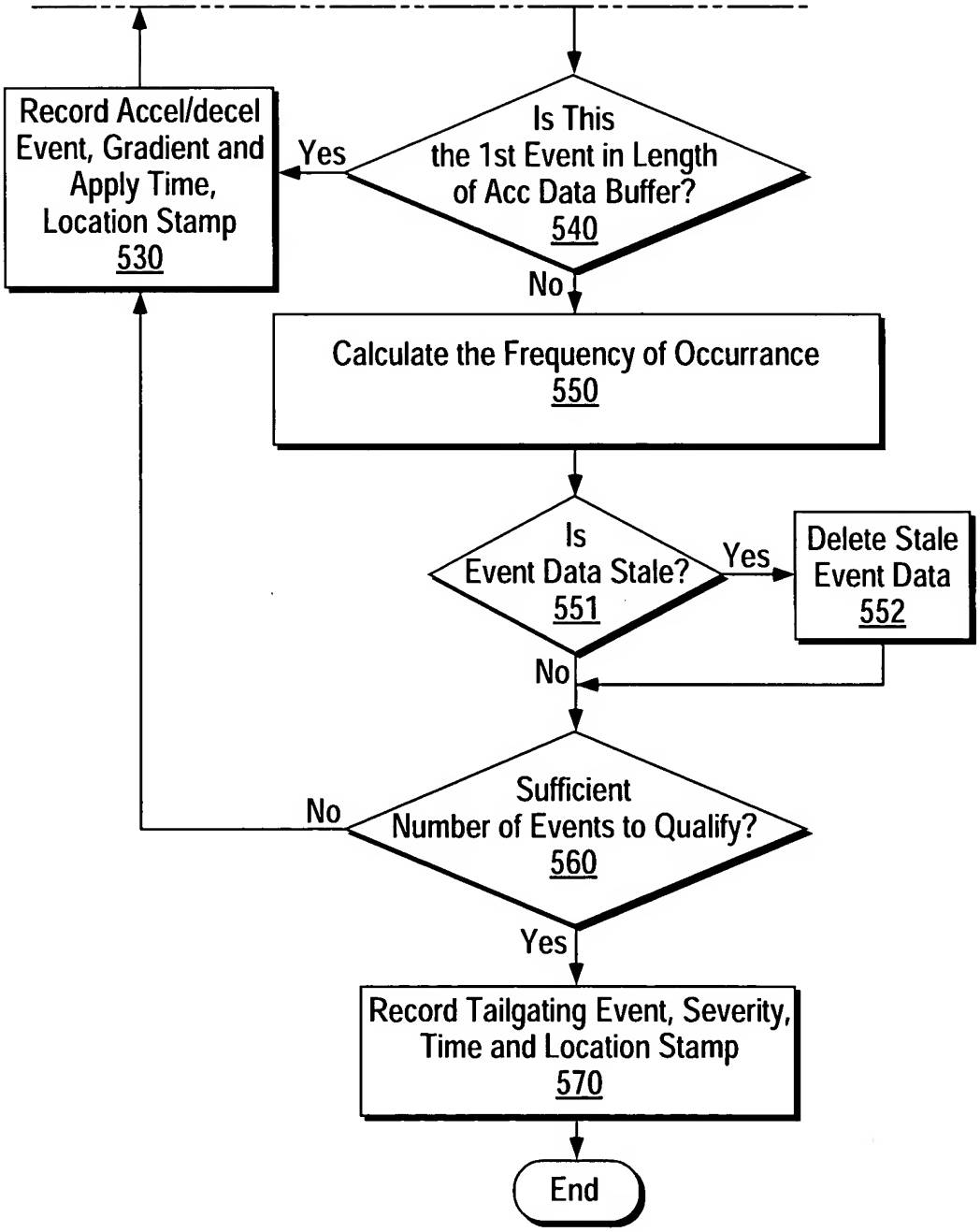

Record Accel/decel Event, Gradient and Apply Time, Location Stamp 530
Yes
Is This the 1st Event in Length of Acc Data Buffer? 540
No
Calculate the Frequency of Occurrance 550
Is Event Data Stale? 551
Yes
Delete Stale Event Data 552
No
Sufficient Number of Events to Qualify? 560
No
Yes
Record Tailgating Event, Severity, Time and Location Stamp 570
End

FIG. 7A

FIG. 7
FIG. 7A
FIG. 7B

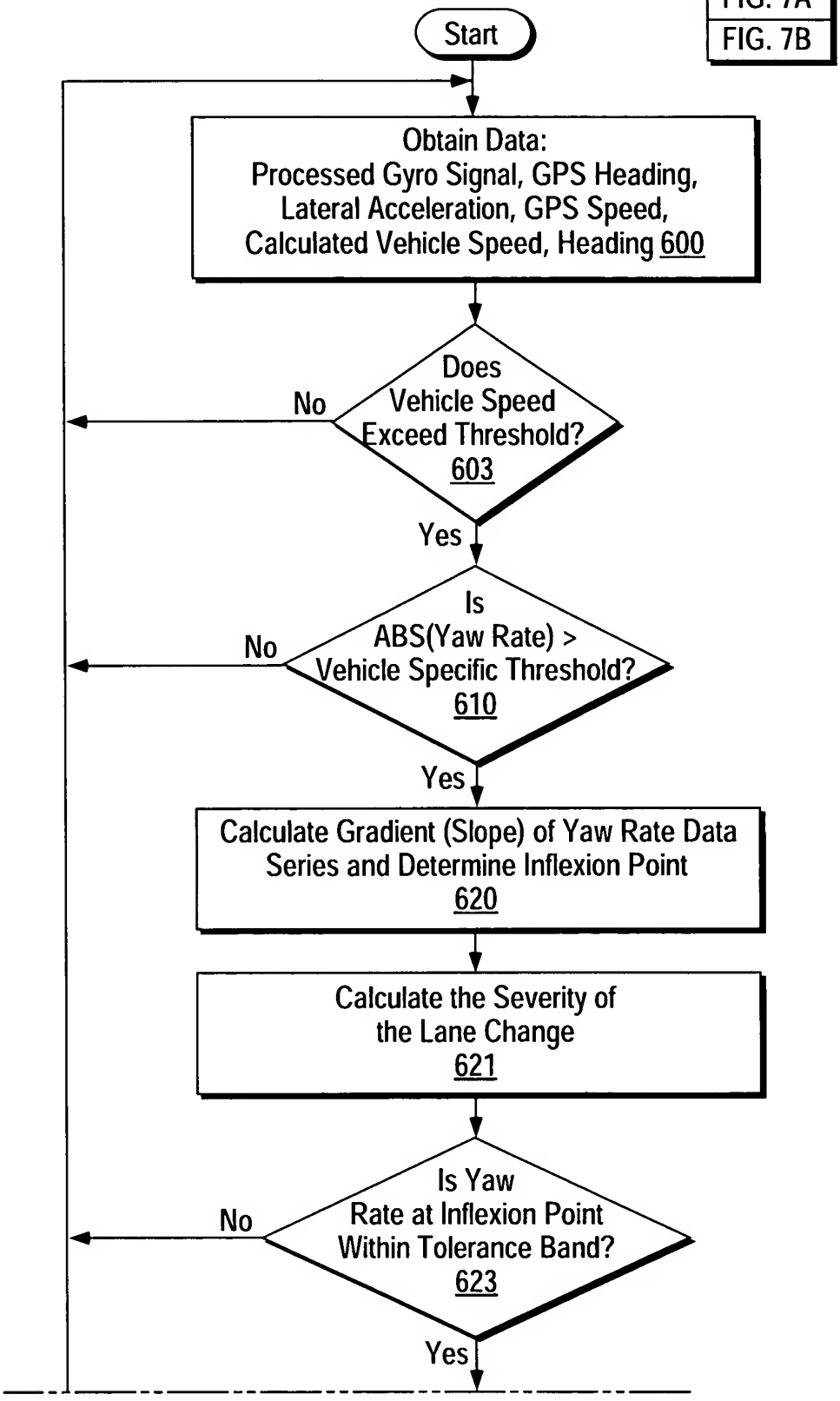


FIG. 7B

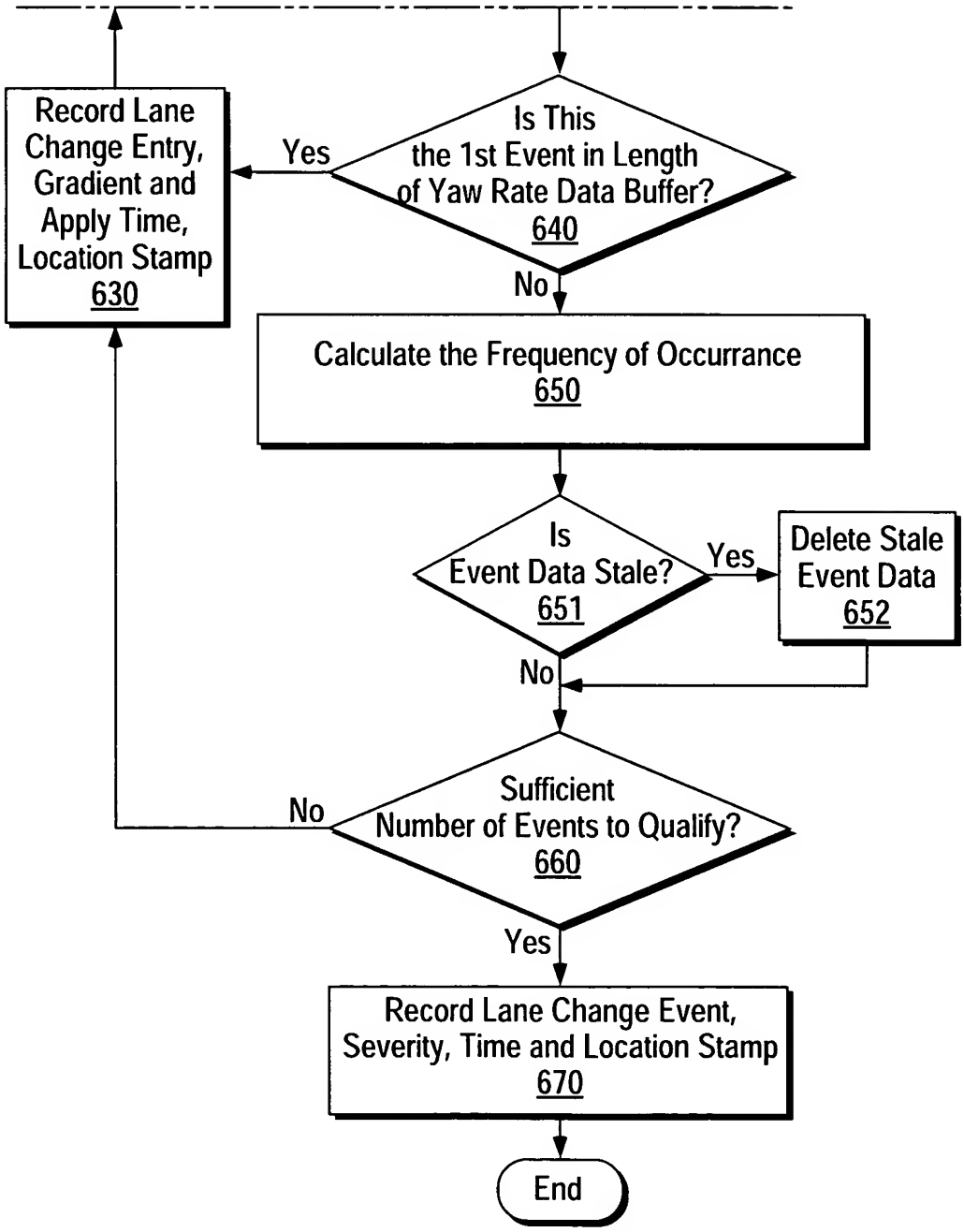

Record Lane Change Entry, Gradient and Apply Time, Location Stamp 630
Yes
Is This the 1st Event in Length of Yaw Rate Data Buffer? 640
No
Calculate the Frequency of Occurrance 650
Is Event Data Stale? 651
Yes
Delete Stale Event Data 652
No
Sufficient Number of Events to Qualify? 660
No
Yes
Record Lane Change Event, Severity, Time and Location Stamp 670
End

FIG. 8A

FIG. 8
FIG. 8A
FIG. 8B

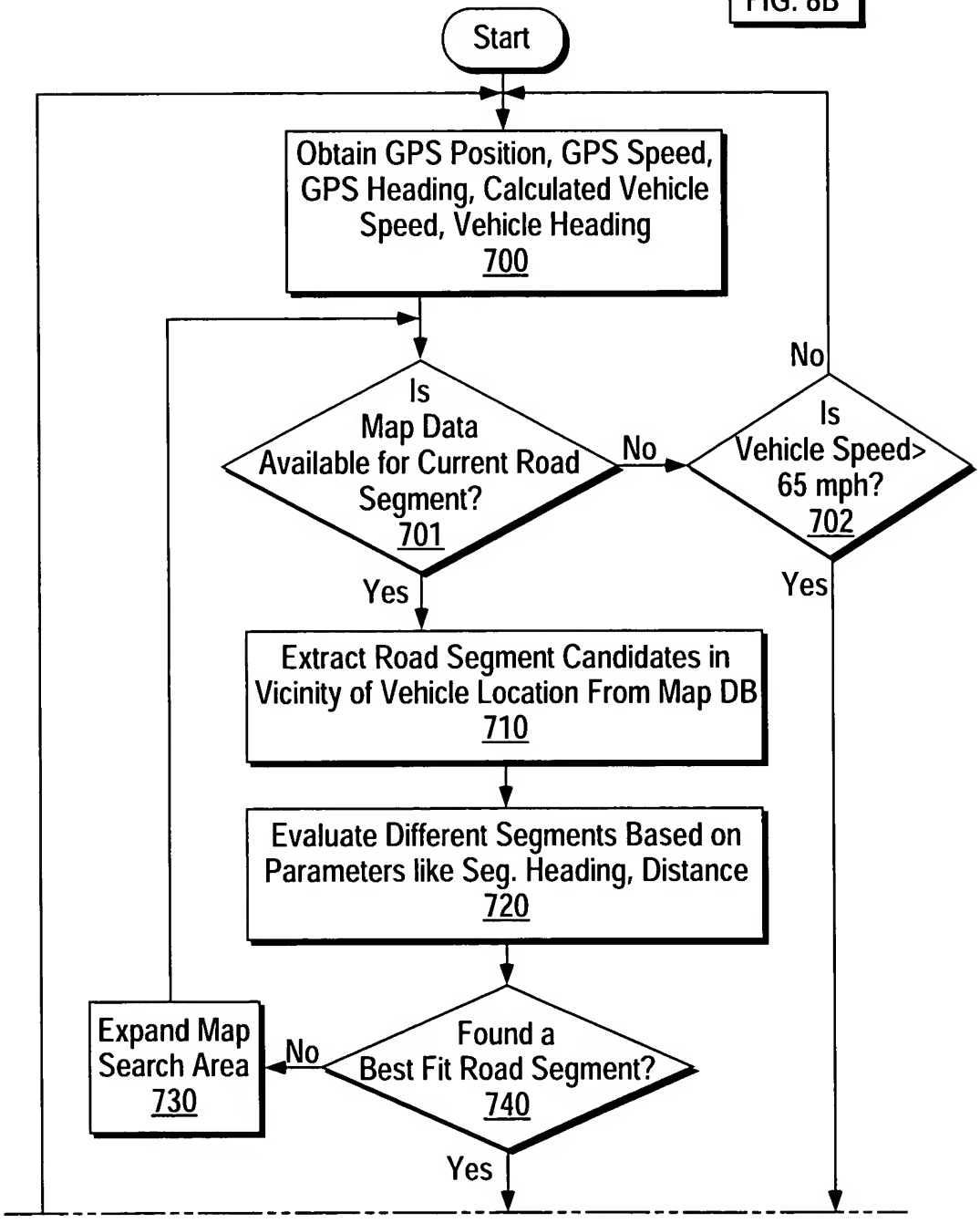


FIG. 8B

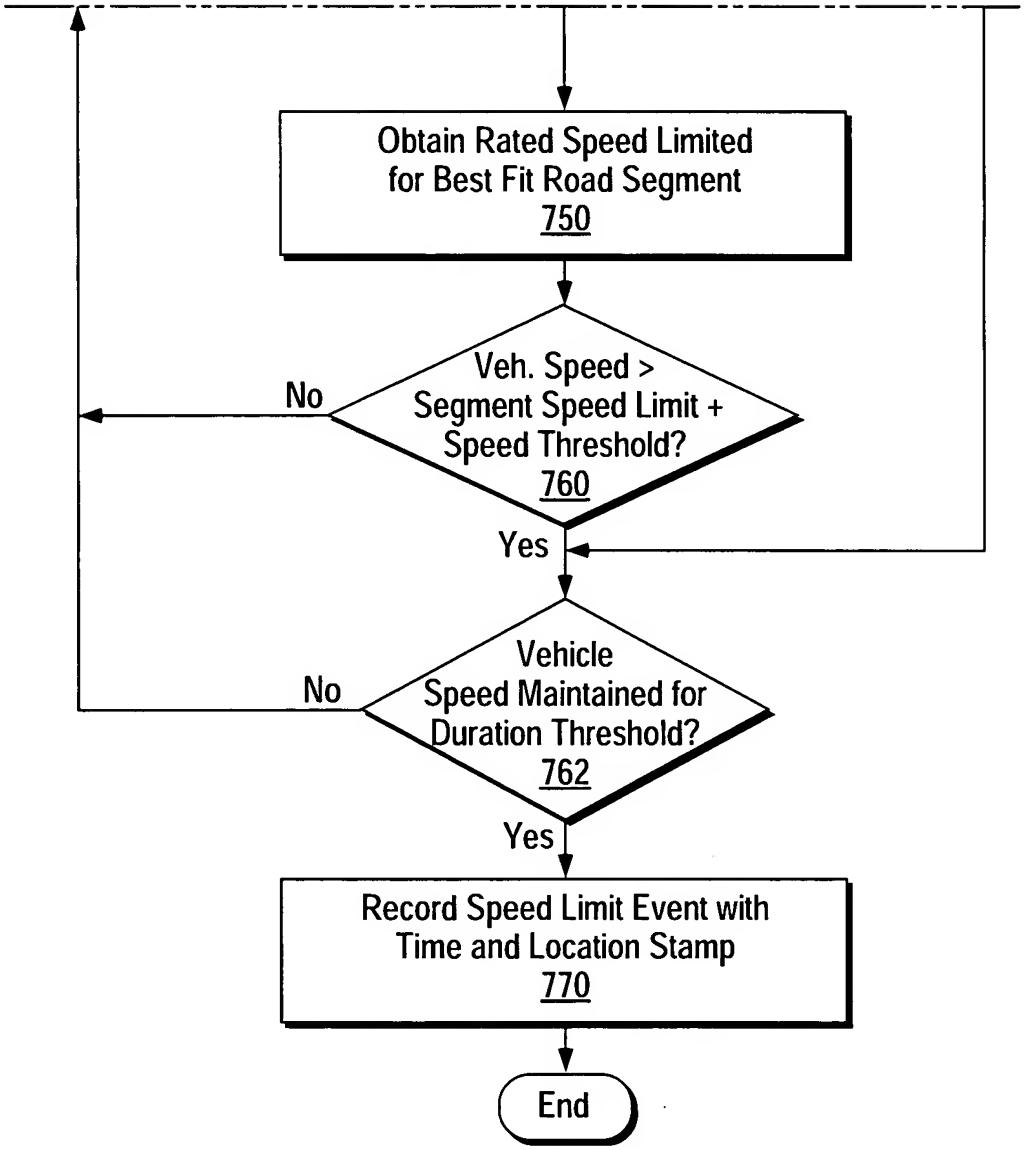

Obtain Rated Speed Limited for Best Fit Road Segment
750
Veh. Speed > Segment Speed Limit + Speed Threshold?
760
No
Yes
Vehicle Speed Maintained for Duration Threshold?
762
No
Yes
Record Speed Limit Event with Time and Location Stamp
770
End

FIG. 9

FIG. 9A

FIG. 9B

FIG. 9A

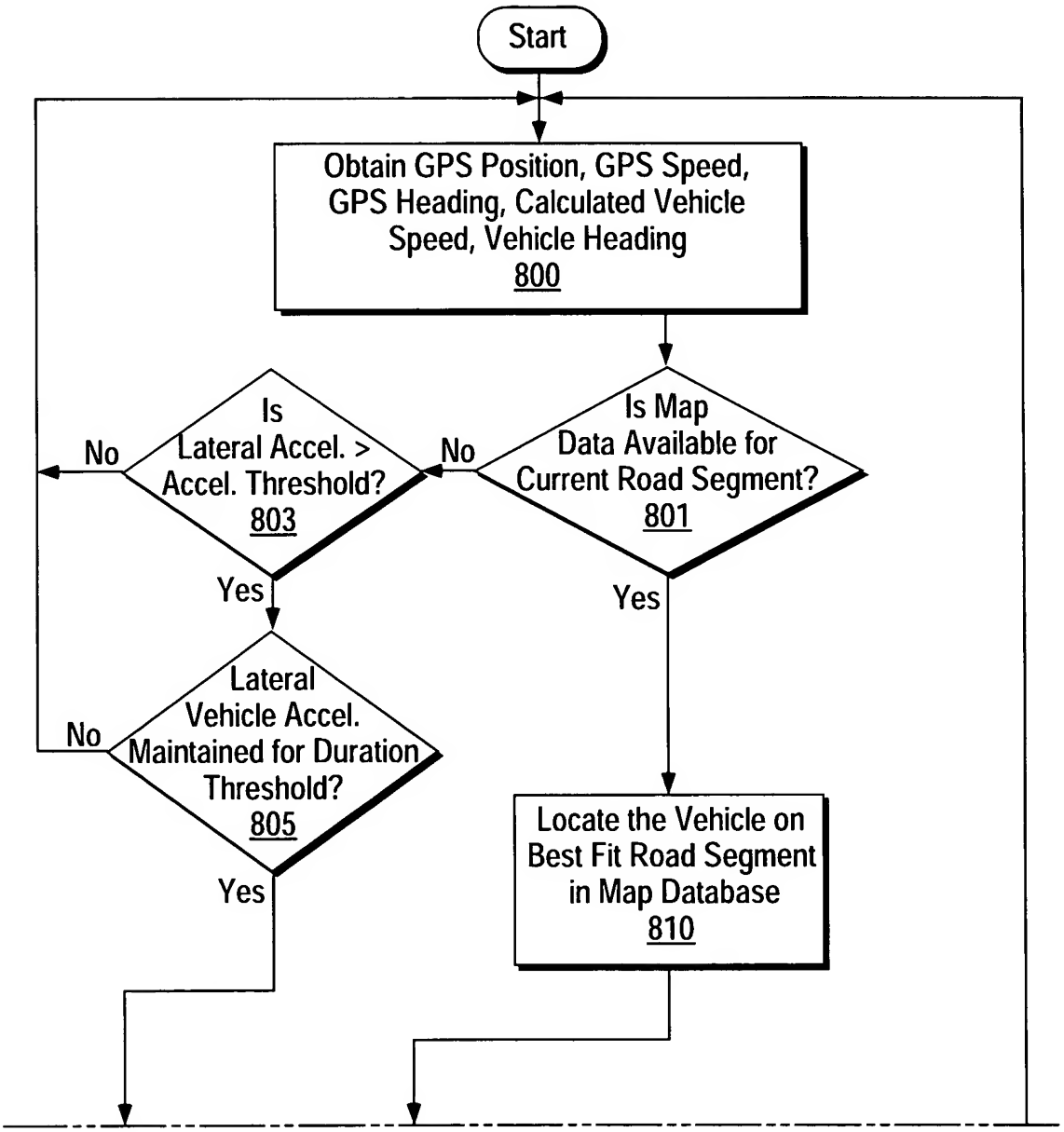
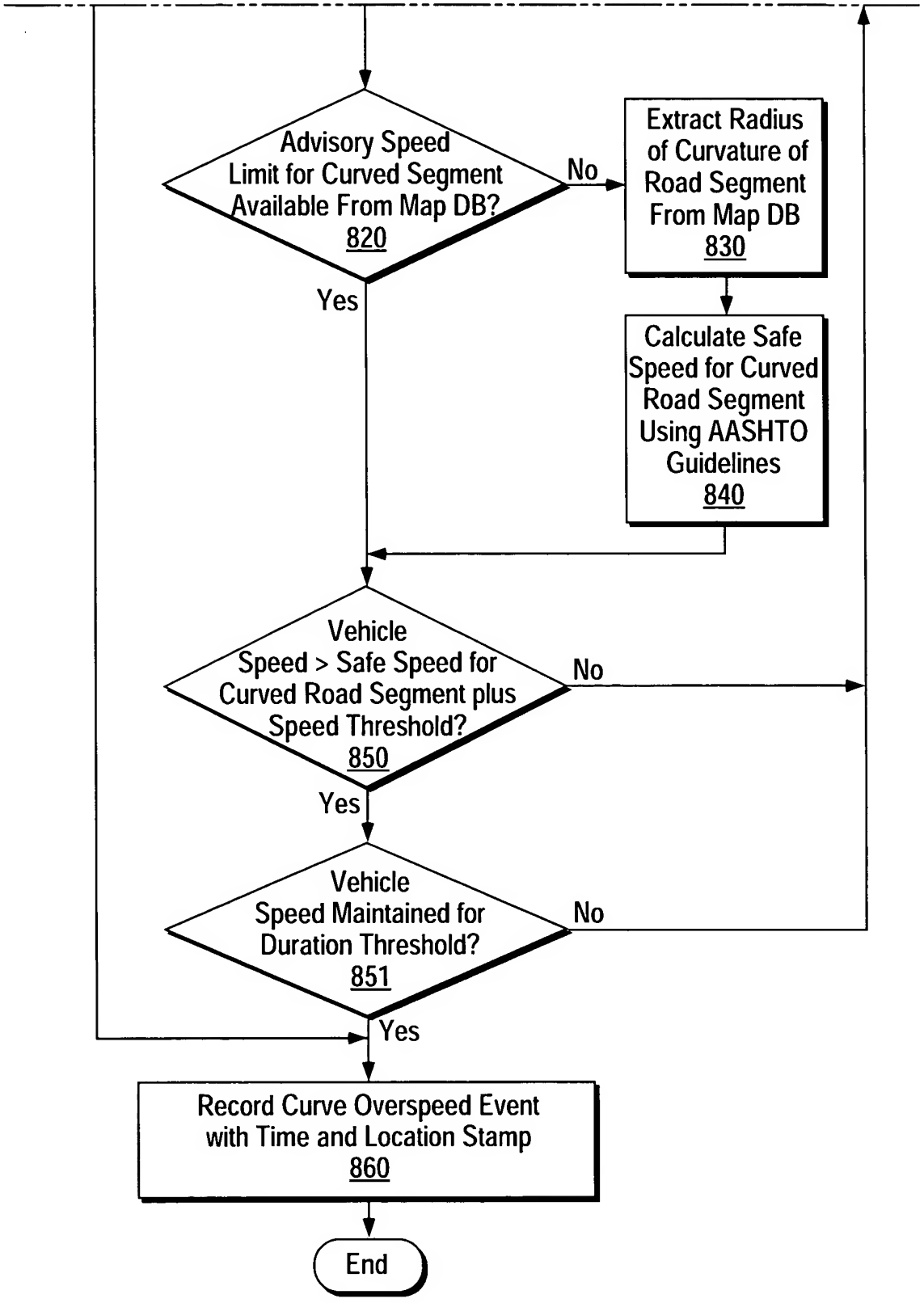


FIG. 9B


Advisory Speed Limit for Curved Segment Available From Map DB? 820
No
Extract Radius of Curvature of Road Segment From Map DB 830
Yes
Calculate Safe Speed for Curved Road Segment Using AASHTO Guidelines 840
Vehicle Speed > Safe Speed for Curved Road Segment plus Speed Threshold? 850
No
Yes
Vehicle Speed Maintained for Duration Threshold? 851
No
Yes
Record Curve Overspeed Event with Time and Location Stamp 860
End

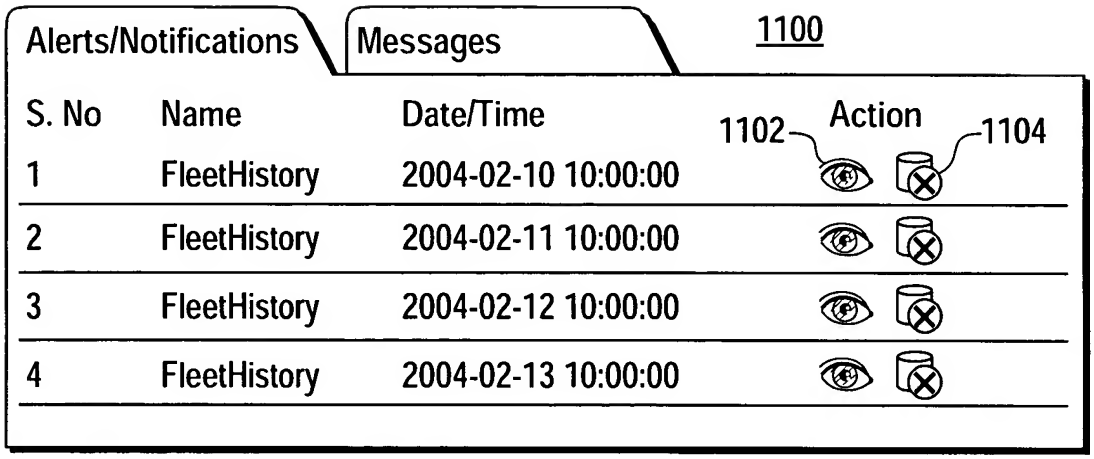

Alerts/Notifications
Messages
1100
S. No
Name
Date/Time
Action
1102
1104
1
FleetHistory
2004-02-10 10:00:00
2
FleetHistory
2004-02-11 10:00:00
3
FleetHistory
2004-02-12 10:00:00
4
FleetHistory
2004-02-13 10:00:00

FIG. 10

Total Fleet Safety Historical Report

Fleet Name Star Fleet

Period From: 2/01/2002 To: 2/26/2004, Yearly

Period	TG	FL	OS	CS	RA	RS	Total
2003	4	4	4	4	4	0	20
2004	0	0	0	0	1	3	4

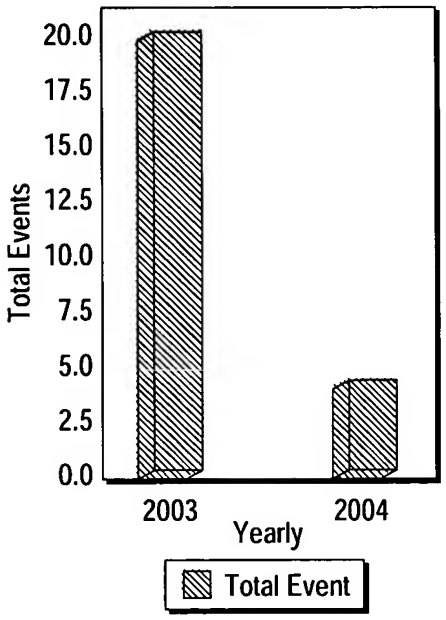


FIG. 11

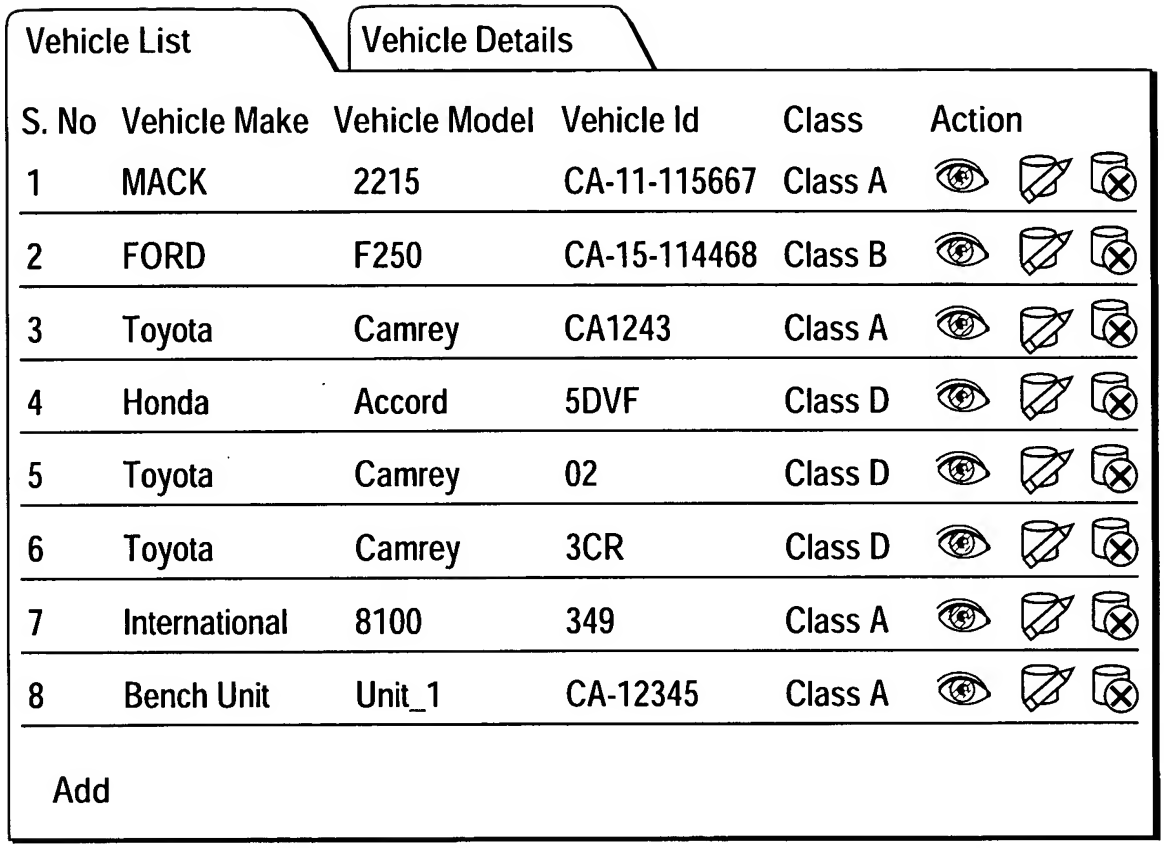

Vehicle List
Vehicle Details
S. No
Vehicle Make
Vehicle Model
Vehicle Id
Class
Action
1 MACK 2215 CA-11-115667 Class A
2 FORD F250 CA-15-114468 Class B
3 Toyota Camrey CA1243 Class A
4 Honda Accord 5DVF Class D
5 Toyota Camrey 02 Class D
6 Toyota Camrey 3CR Class D
7 International 8100 349 Class A
8 Bench Unit Unit_1 CA-12345 Class A
Add

FIG. 12

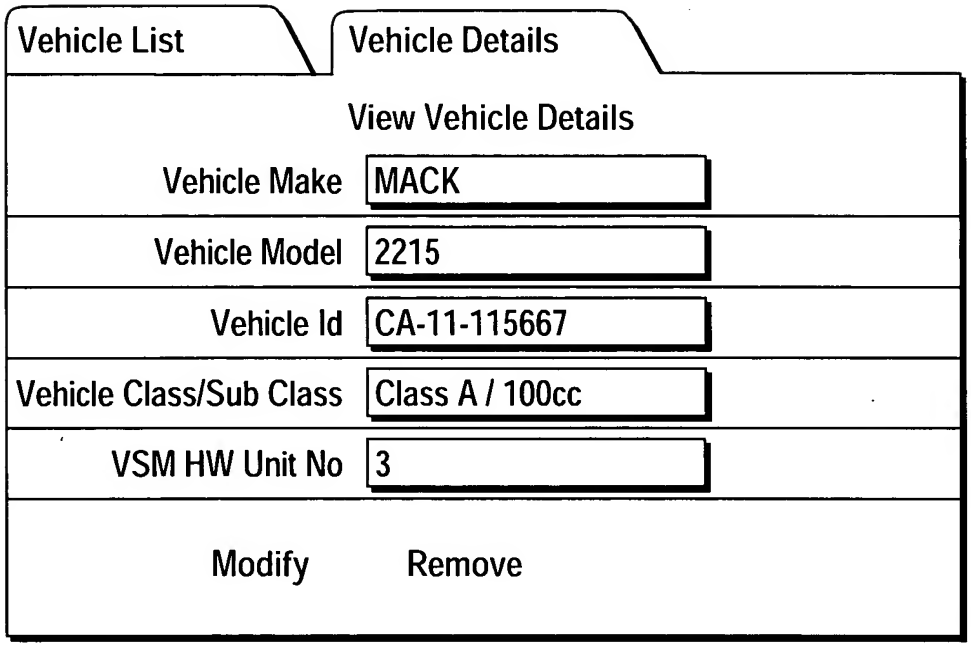

Vehicle List
Vehicle Details
View Vehicle Details
Vehicle Make
MACK
Vehicle Model
2215
Vehicle Id
CA-11-115667
Vehicle Class/Sub Class
Class A / 100cc
VSM HW Unit No
3
Modify
Remove

FIG. 13

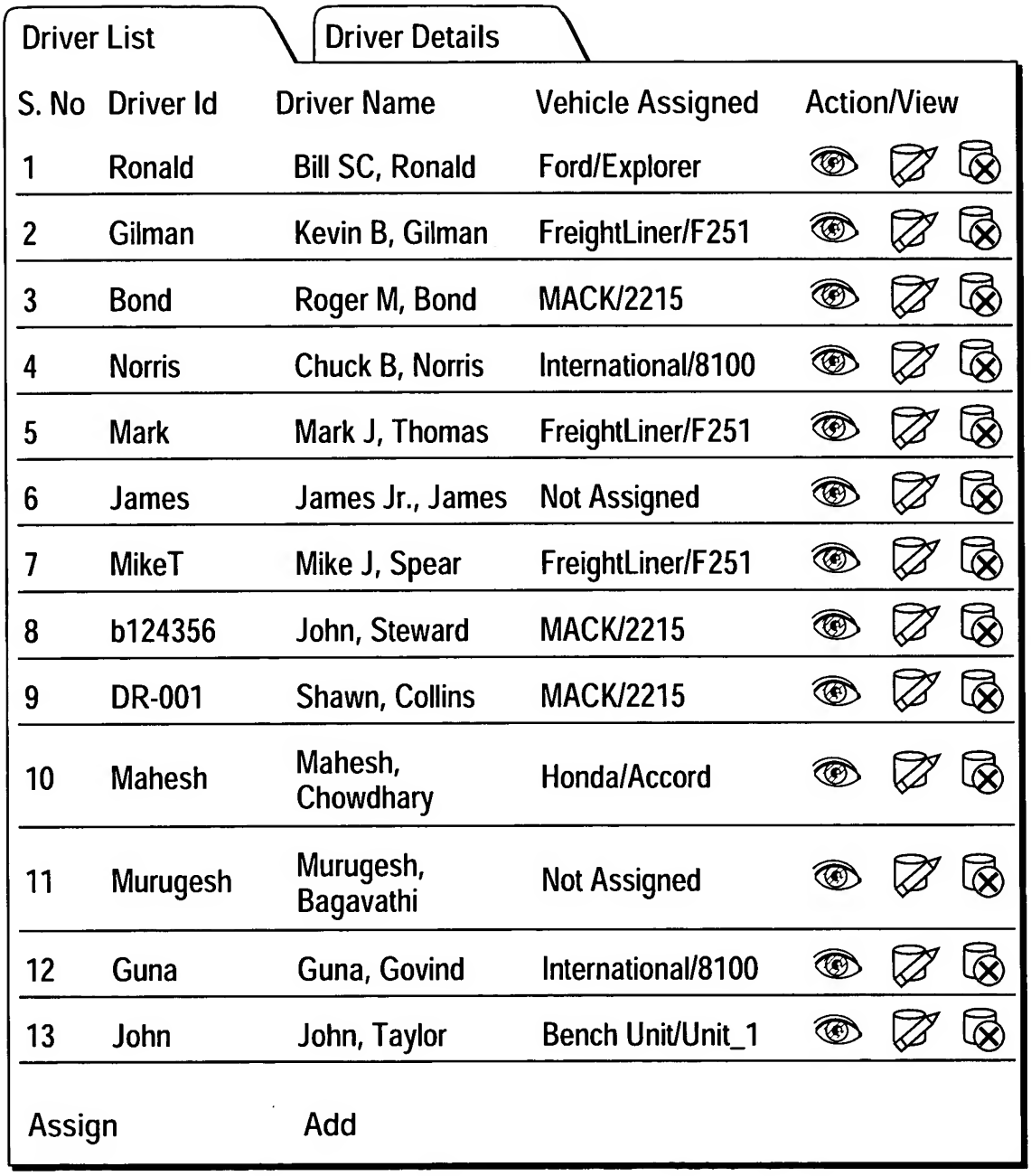

Driver List
Driver Details
S. No
Driver Id
Driver Name
Vehicle Assigned
Action/View
1 Ronald Bill SC, Ronald Ford/Explorer
2 Gilman Kevin B, Gilman FreightLiner/F251
3 Bond Roger M, Bond MACK/2215
4 Norris Chuck B, Norris International/8100
5 Mark Mark J, Thomas FreightLiner/F251
6 James James Jr., James Not Assigned
7 MikeT Mike J, Spear FreightLiner/F251
8 b124356 John, Steward MACK/2215
9 DR-001 Shawn, Collins MACK/2215
10 Mahesh Mahesh, Chowdhary Honda/Accord
11 Murugesh Murugesh, Bagavathi Not Assigned
12 Guna Guna, Govind International/8100
13 John John, Taylor Bench Unit/Unit_1
Assign
Add

FIG. 14

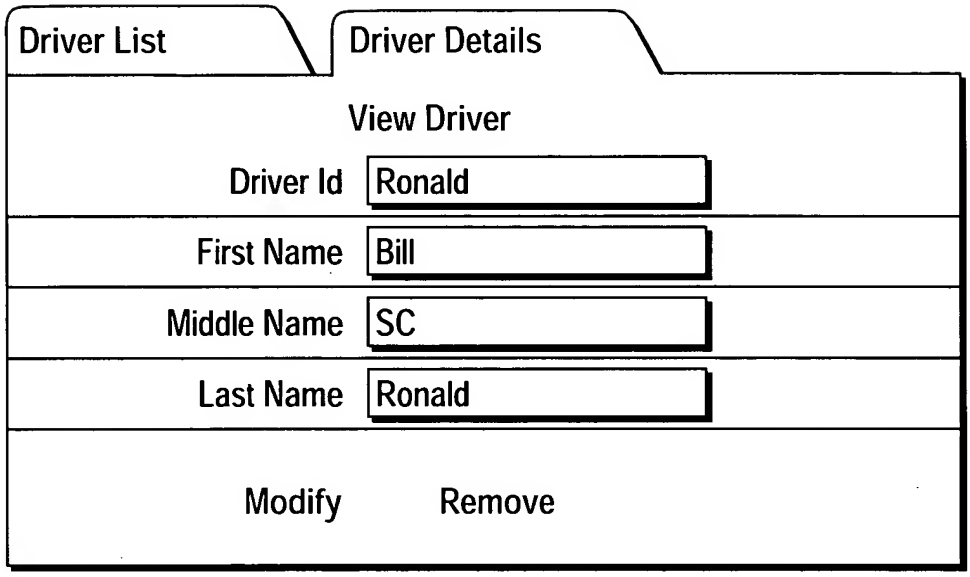

Driver List
Driver Details
View Driver
Driver Id
Ronald
First Name
Bill
Middle Name
SC
Last Name
Ronald
Modify
Remove

FIG. 15

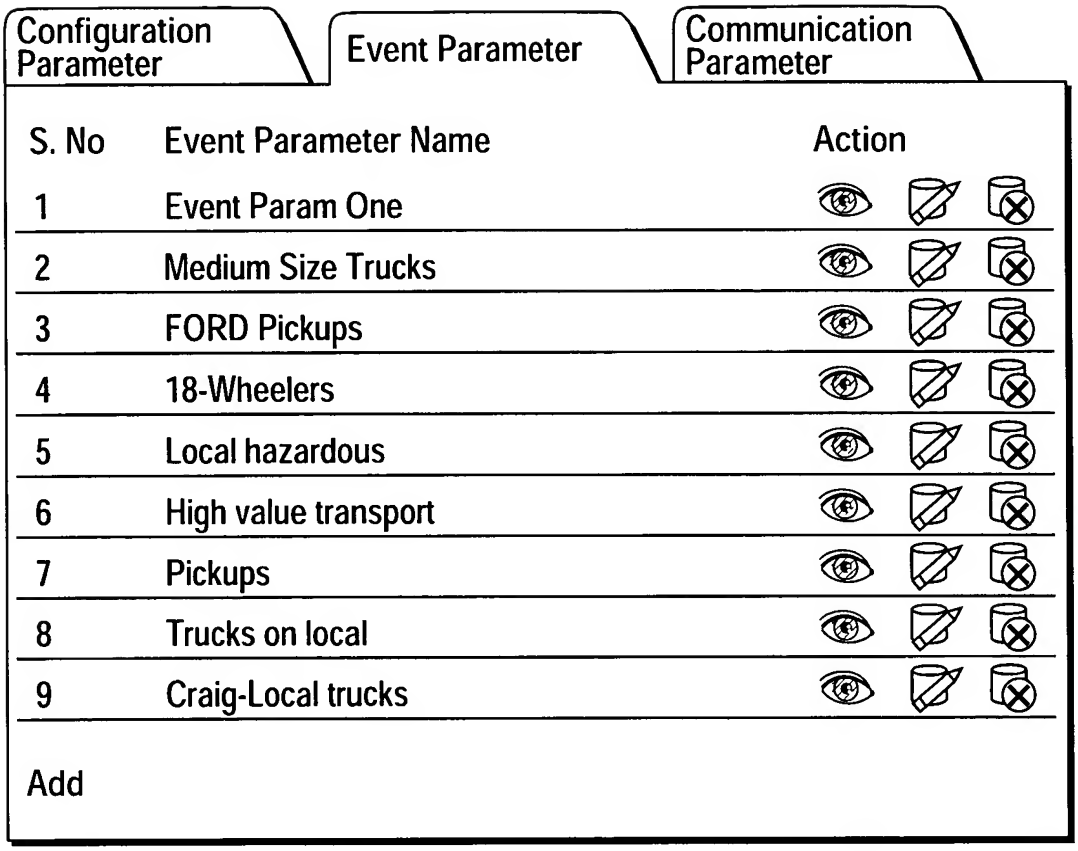

Configuration Parameter
Event Parameter
Communication Parameter
S. No
Event Parameter Name
Action
1
Event Param One
2
Medium Size Trucks
3
FORD Pickups
4
18-Wheelers
5
Local hazardous
6
High value transport
7
Pickups
8
Trucks on local
9
Craig-Local trucks
Add

FIG. 16

Event Parameter List | Event Parameter Details

View Event Parameter

Event Parameter Name	Event Param One	
Over Speeding		
Speed Threshold Parameter		
For Highway (default 5 mph)	2	range (0 mph to 20 mph)
For City Street (default 5 mph)	5	range (0 mph to 15 mph)
Duration Threshold		
For Highway (default 5 mph)	5	range (0 mph to 20 mph)
For City Street (default 5 mph)	5	range (0 mph to 15 mph)
Curve Over-Speed Violation		
Speed Threshold Parameter		
(default 5 mph)	5	range (0 mph to 15 mph)
Duration Threshold		
(default 4 sec)	4	range (0 sec to 10 sec)
Rapid Acceleration		
Speed Threshold Parameter		
(default 0.15 g)	0.15	range (0.1 g to 0.4 g)
Duration Threshold		
(default 1 sec)	1	range (1 sec to 4 sec)
Rapid Deceleration		
Speed Threshold Parameter		
(default 0.18 g)	0.17	range (0.1 g to 0.65 g)
Duration Threshold		
(default 1 sec)	1	range (1 sec to 4 sec)

FIG. 17A

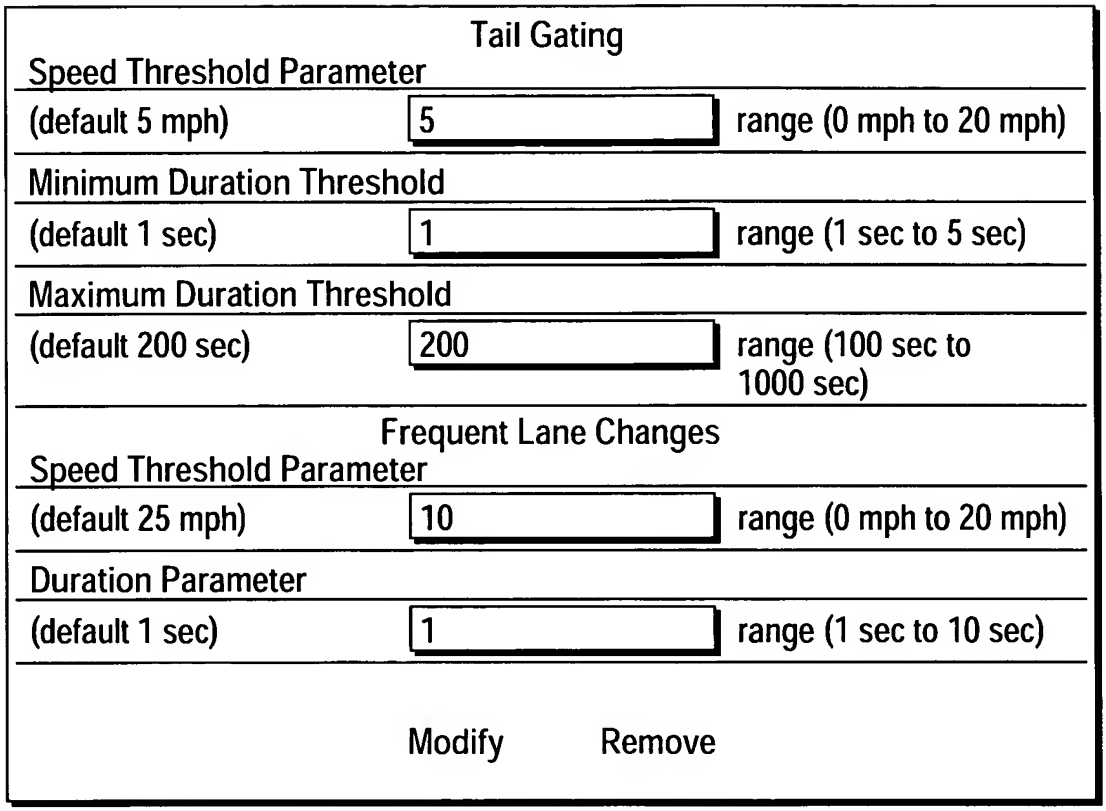

Tail Gating
Speed Threshold Parameter
(default 5 mph)
5
range (0 mph to 20 mph)
Minimum Duration Threshold
(default 1 sec)
1
range (1 sec to 5 sec)
Maximum Duration Threshold
(default 200 sec)
200
range (100 sec to 1000 sec)
Frequent Lane Changes
Speed Threshold Parameter
(default 25 mph)
10
range (0 mph to 20 mph)
Duration Parameter
(default 1 sec)
1
range (1 sec to 10 sec)
Modify
Remove

FIG. 17B

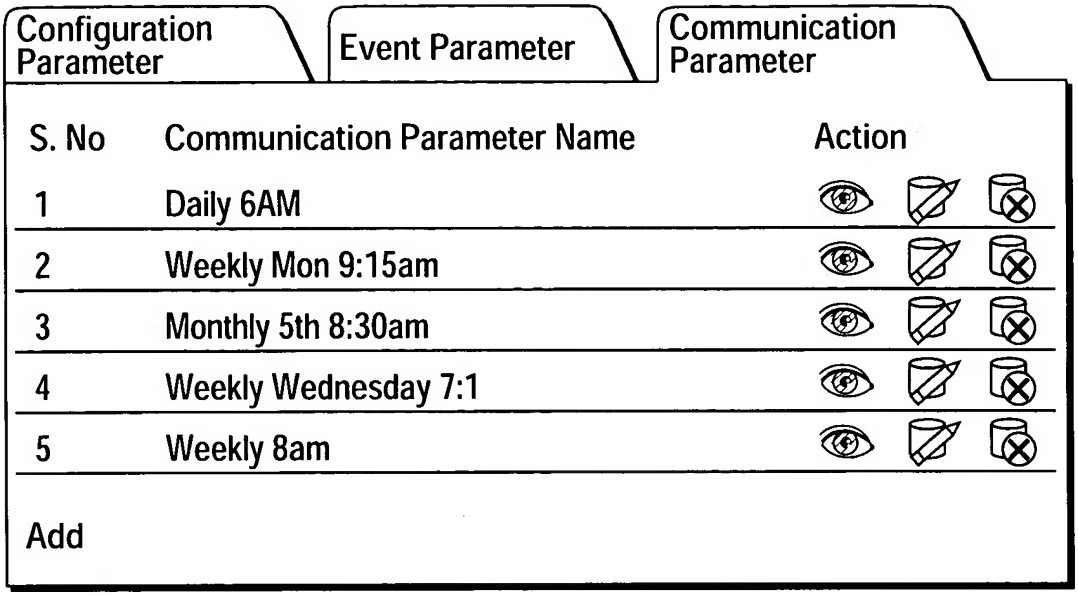

Configuration Parameter
Event Parameter
Communication Parameter
S. No
Communication Parameter Name
Action
1
Daily 6AM
2
Weekly Mon 9:15am
3
Monthly 5th 8:30am
4
Weekly Wednesday 7:1
5
Weekly 8am
Add

FIG. 18

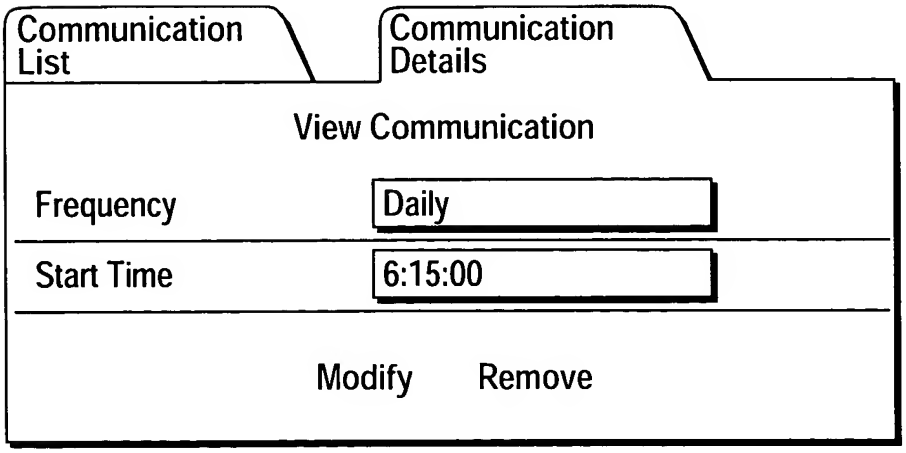

Communication List
Communication Details
View Communication
Frequency
Daily
Start Time
6:15:00
Modify
Remove

FIG. 19

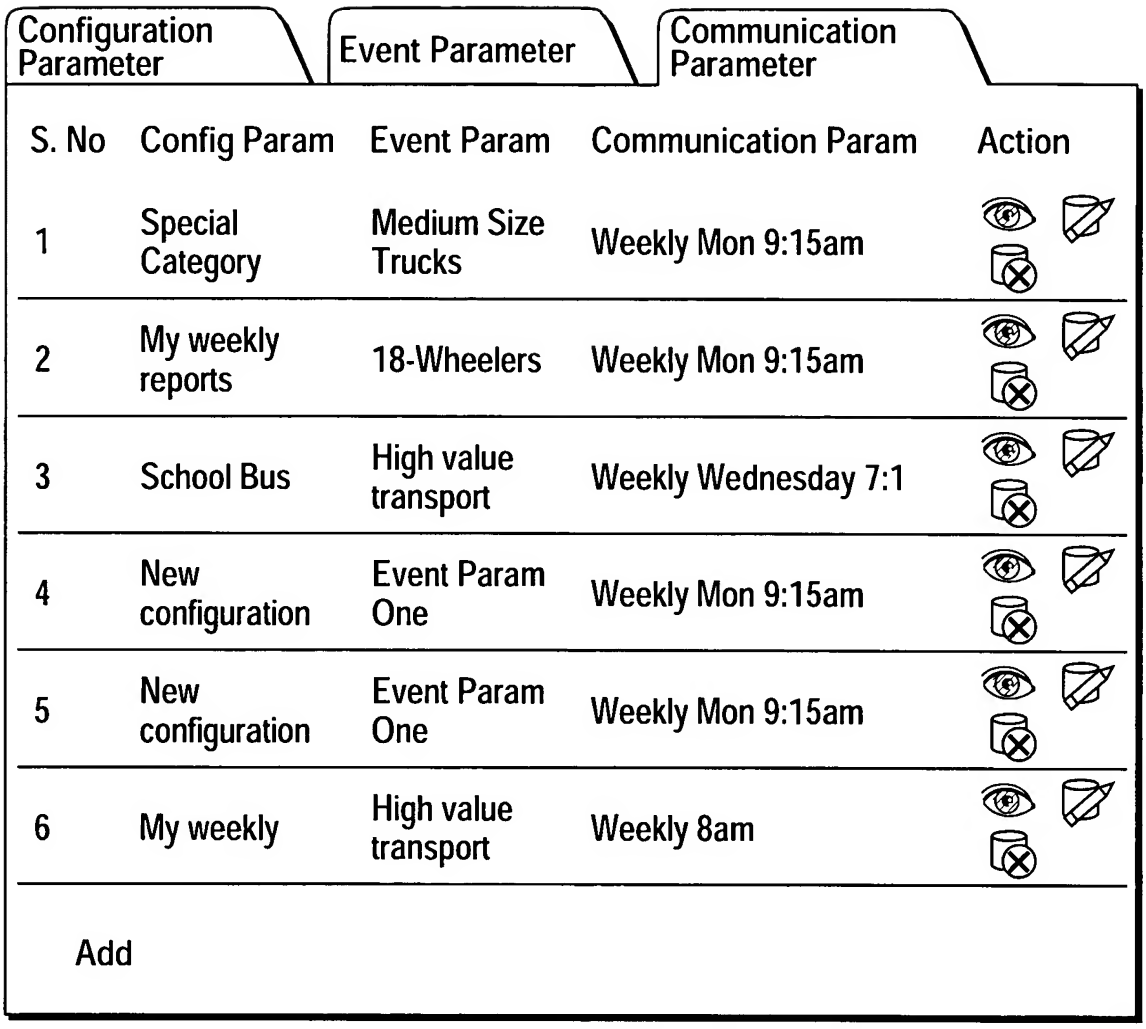

Configuration Parameter
Event Parameter
Communication Parameter
S. No
Config Param
Event Param
Communication Param
Action
1
Special Category
Medium Size Trucks
Weekly Mon 9:15am
2
My weekly reports
18-Wheelers
Weekly Mon 9:15am
3
School Bus
High value transport
Weekly Wednesday 7:1
4
New configuration
Event Param One
Weekly Mon 9:15am
5
New configuration
Event Param One
Weekly Mon 9:15am
6
My weekly
High value transport
Weekly 8am
Add

FIG. 20

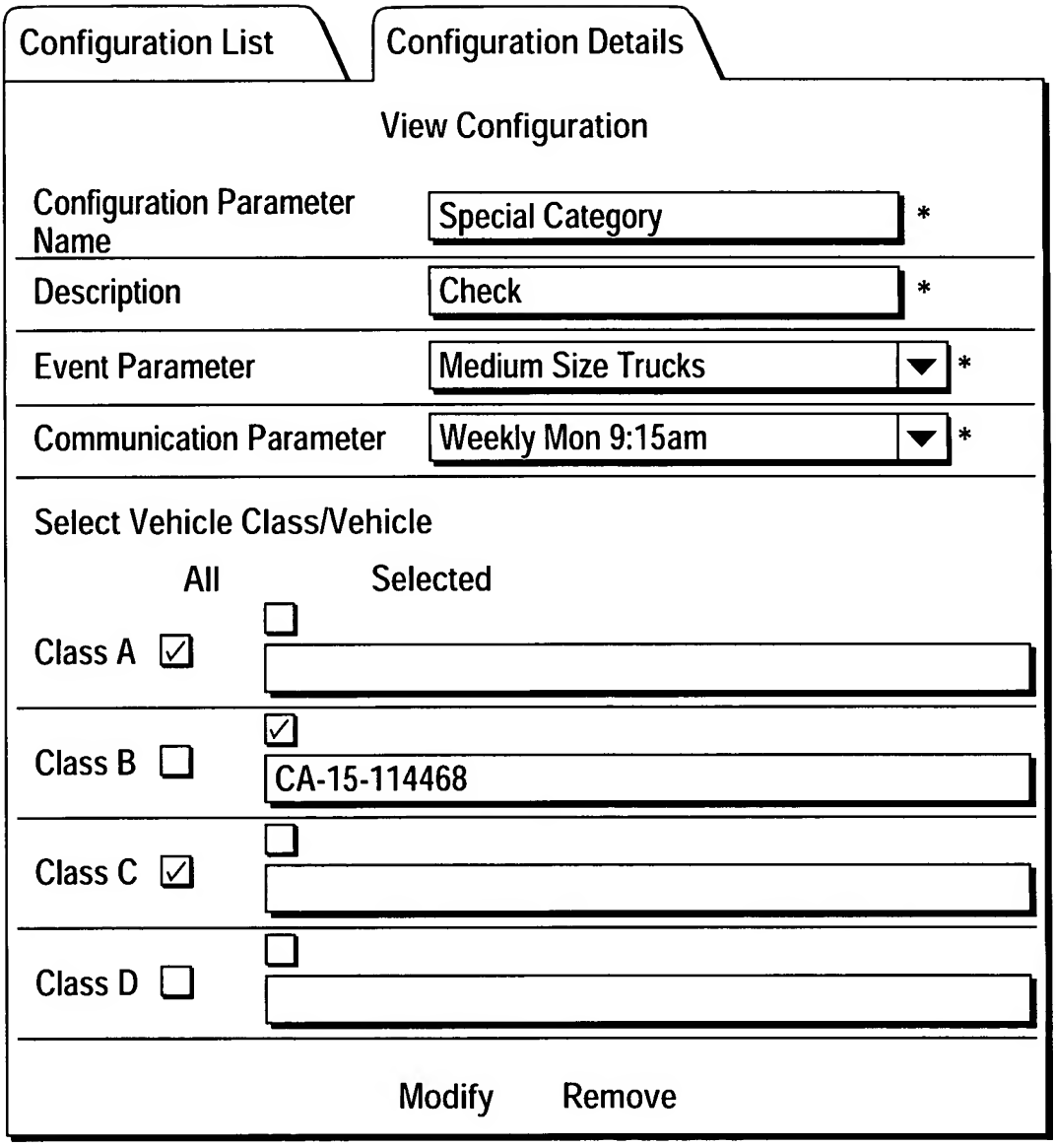

Configuration List
Configuration Details
View Configuration
Configuration Parameter Name
Special Category
*
Description
Check
*
Event Parameter
Medium Size Trucks
*
Communication Parameter
Weekly Mon 9:15am
*
Select Vehicle Class/Vehicle
All
Selected
Class A
Class B
CA-15-114468
Class C
Class D
Modify
Remove

FIG. 21

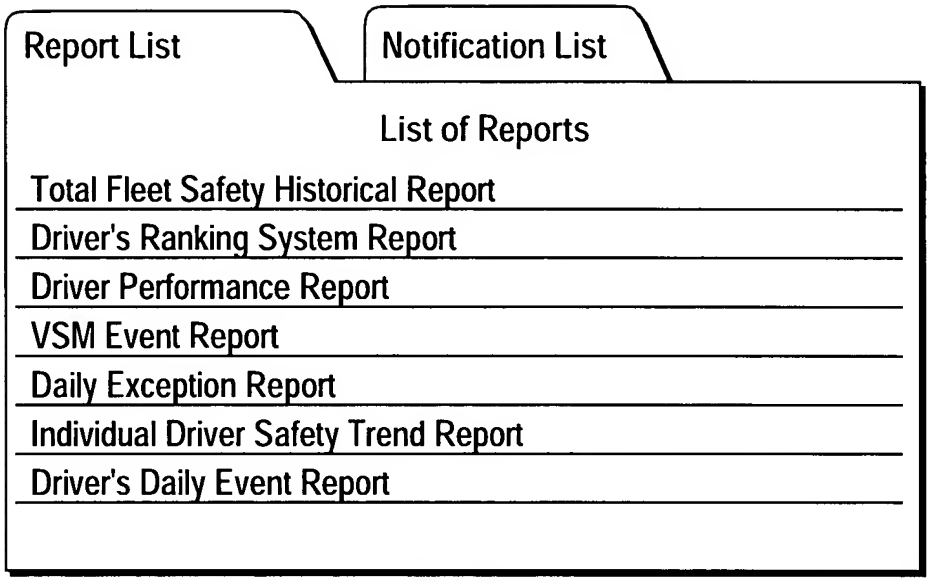

Report List
Notification List
List of Reports
Total Fleet Safety Historical Report
Driver's Ranking System Report
Driver Performance Report
VSM Event Report
Daily Exception Report
Individual Driver Safety Trend Report
Driver's Daily Event Report

FIG. 22

Total Fleet Safety Historical Report

Fleet: Fleet_Name
Period: Year 2002, Monthly

Period	OS	TG	CS	FL	RA	RS	Total
Jan	20	22	18	16	11	23	110
Feb	18	28	4	22	10	15	97
Mar	21	11	6	21	9	18	96
April	33	21	9	10	13	11	97
May	10	15	5	25	18	15	88
June	5	10	25	10	20	10	80
Jul	15	18	12	13	7	21	86
Aug	19	14	27	20	10	2	92
Sep	12	9	16	18	31	5	90
Oct	18	0	0	29	30	10	87
Nov	17	12	9	22	19	40	120
Dec	42	12	43	12	18	32	159

OS: Over Speed, TG: Tailgate, CS: Curve negotiating Speed,
FL: Frequent Lane change, RA: Rapid Acceleration, RS: Rapid Stops

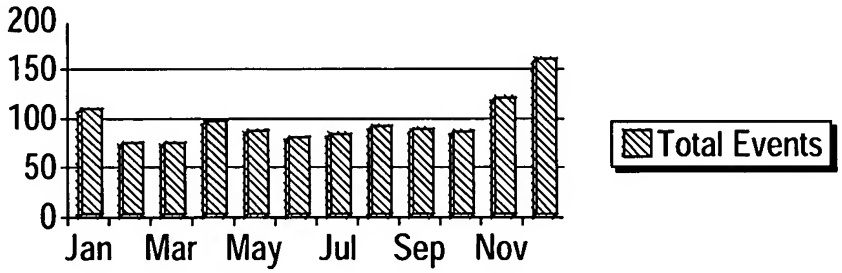


FIG. 23

Driver Rankings by Event/Score

Fleet: Fleet_Name
Period: March, Year 2002

Period	OS	TG	CS	FL	RA	RS	Total Events	Score
James	4	3	4	8	26	13	58	45
Jay	6	8	12	14	32	12	84	58
David	9	12	6	12	40	30	109	65
Herman	12	0	7	16	32	45	112	72
Miller	8	16	19	18	55	38	154	86
Danny	19	7	21	23	32	42	144	98
Mason	18	19	31	37	45	52	202	124
Susan	21	11	12	29	82	64	219	156
Sam	22	15	22	40	70	68	237	190
Bran	24	18	24	30	89	72	257	230

OS: Over Speed, TG: Tailgate, CS: Curve negotiating Speed,
FL: Frequent Lane change, RA: Rapid Acceleration, RS: Rapid Stops

FIG. 24

Driver's Performance Report

Fleet: Fleet_Name
Driver ID: 045236
Name: Bill Martin
Period: 10/01/2002 to 10/15/2002

Event Number	Event Type	Location	Violation	Score
2345	RA	Lawrence Exp X El Camino towards Lawrence Exp North	0-60 in 30 sec (75)	4
2356	OS	San Tomas X El Camino towards San Tomas South	12 miles over 45 miles for 37 seconds	5
2361	OS	Main Street towards North	6 miles over 25 miles for 45 seconds	6
2380	TG	Lawrence Exp X 101 South	1.7 Miles	5
2382	TG	First Street X 101 South	2.3 Miles	7
2385	TG	Kings X 101 South	1.3 Miles	4
2387	OS	Capitol X 101 South	6.2 Miles	6
2397	CS	101(S) to 85(N)	0.4 Miles	7

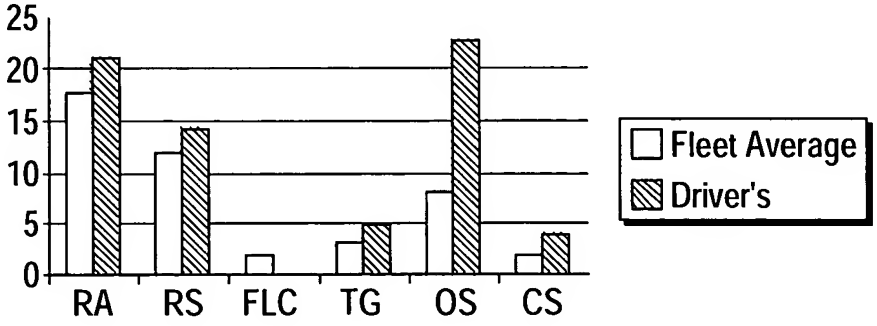


FIG. 25

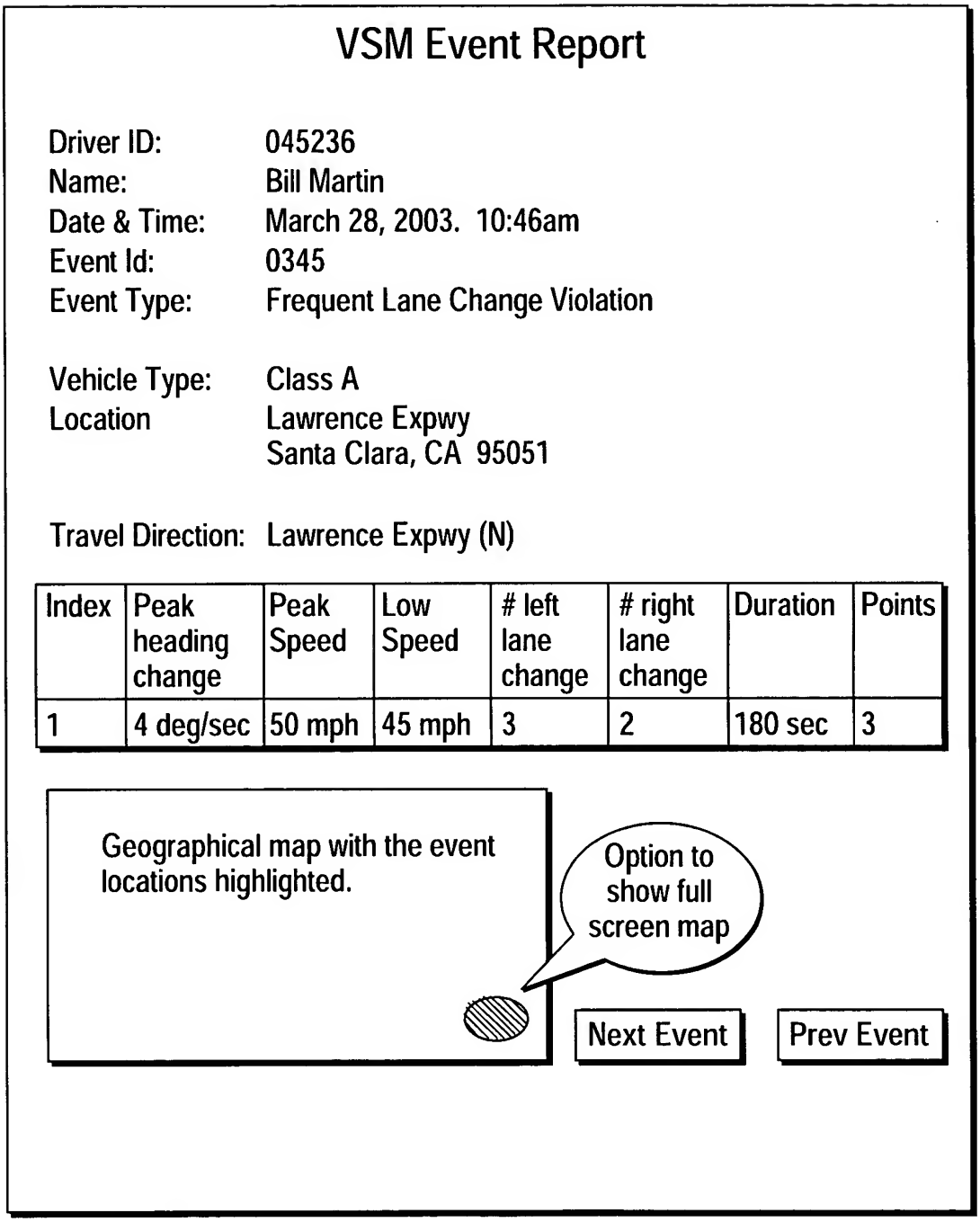

VSM Event Report
Driver ID: 045236
Name: Bill Martin
Date & Time: March 28, 2003. 10:46am
Event Id: 0345
Event Type: Frequent Lane Change Violation
Vehicle Type: Class A
Location Lawrence Expwy
Santa Clara, CA 95051
Travel Direction: Lawrence Expwy (N)
Index
Peak heading change
Peak Speed
Low Speed
left lane change
right lane change
Duration
Points
1
4 deg/sec
50 mph
45 mph
3
2
180 sec
3
Geographical map with the event locations highlighted.
Option to show full screen map
Next Event
Prev Event

FIG. 26

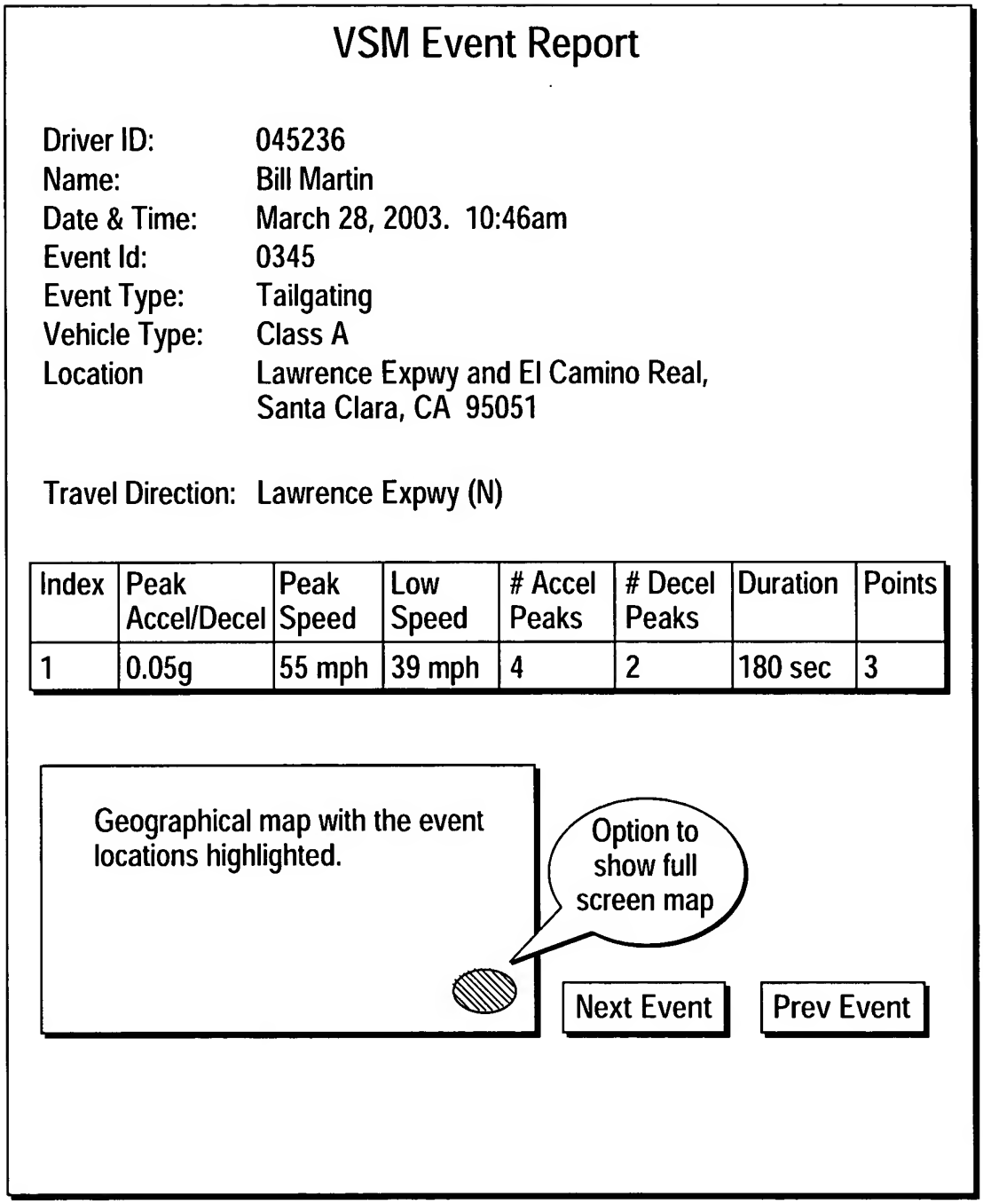

VSM Event Report
Driver ID: 045236
Name: Bill Martin
Date & Time: March 28, 2003. 10:46am
Event Id: 0345
Event Type: Tailgating
Vehicle Type: Class A
Location Lawrence Expwy and El Camino Real, Santa Clara, CA 95051
Travel Direction: Lawrence Expwy (N)
Index | Peak Accel/Decel | Peak Speed | Low Speed | # Accel Peaks | # Decel Peaks | Duration | Points
1 | 0.05g | 55 mph | 39 mph | 4 | 2 | 180 sec | 3
Geographical map with the event locations highlighted.
Option to show full screen map
Next Event
Prev Event

FIG. 27

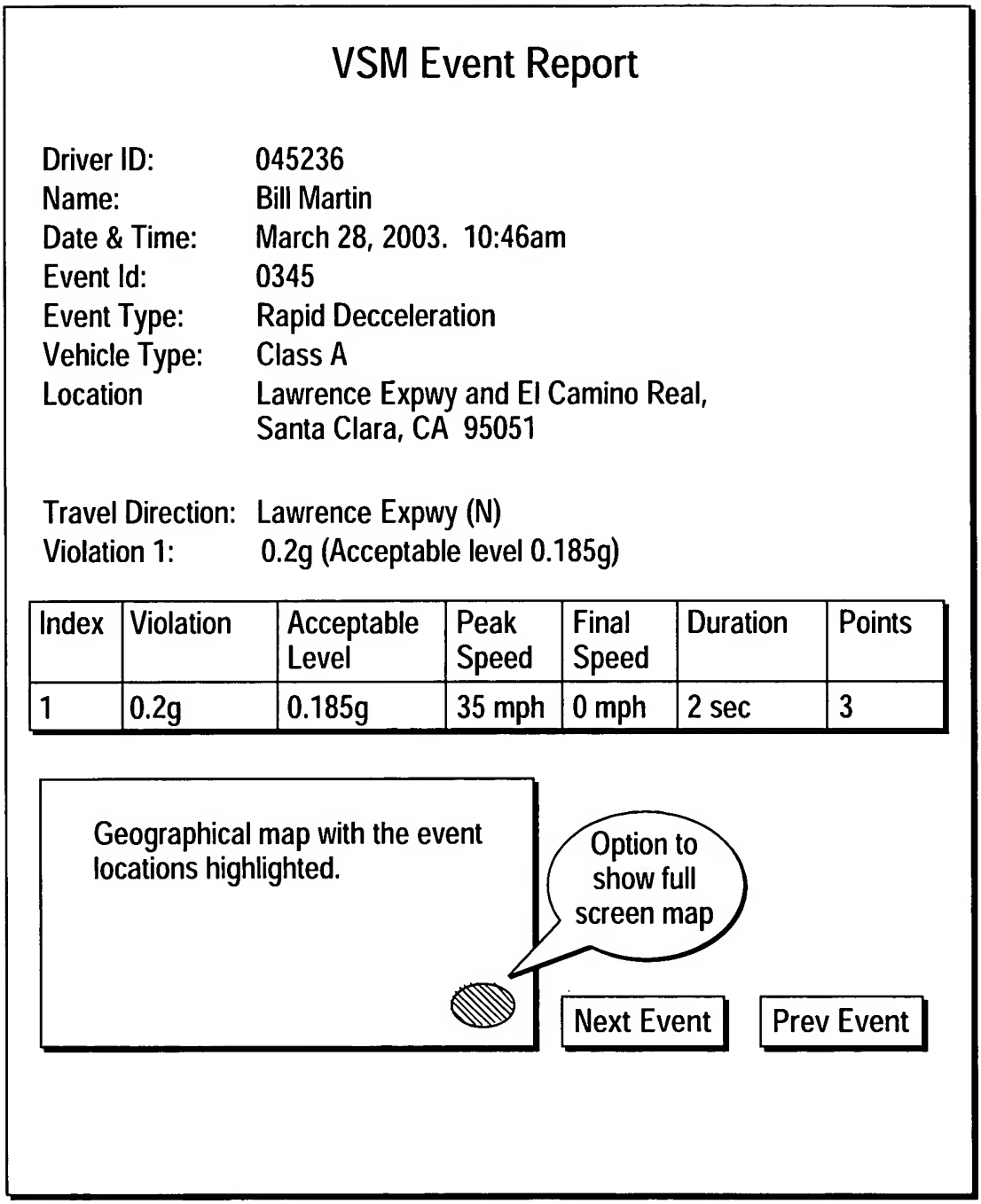

VSM Event Report
Driver ID: 045236
Name: Bill Martin
Date & Time: March 28, 2003. 10:46am
Event Id: 0345
Event Type: Rapid Decceleration
Vehicle Type: Class A
Location Lawrence Expwy and El Camino Real, Santa Clara, CA 95051
Travel Direction: Lawrence Expwy (N)
Violation 1: 0.2g (Acceptable level 0.185g)
Index | Violation | Acceptable Level | Peak Speed | Final Speed | Duration | Points
1 | 0.2g | 0.185g | 35 mph | 0 mph | 2 sec | 3
Geographical map with the event locations highlighted.
Option to show full screen map
Next Event
Prev Event

FIG. 28

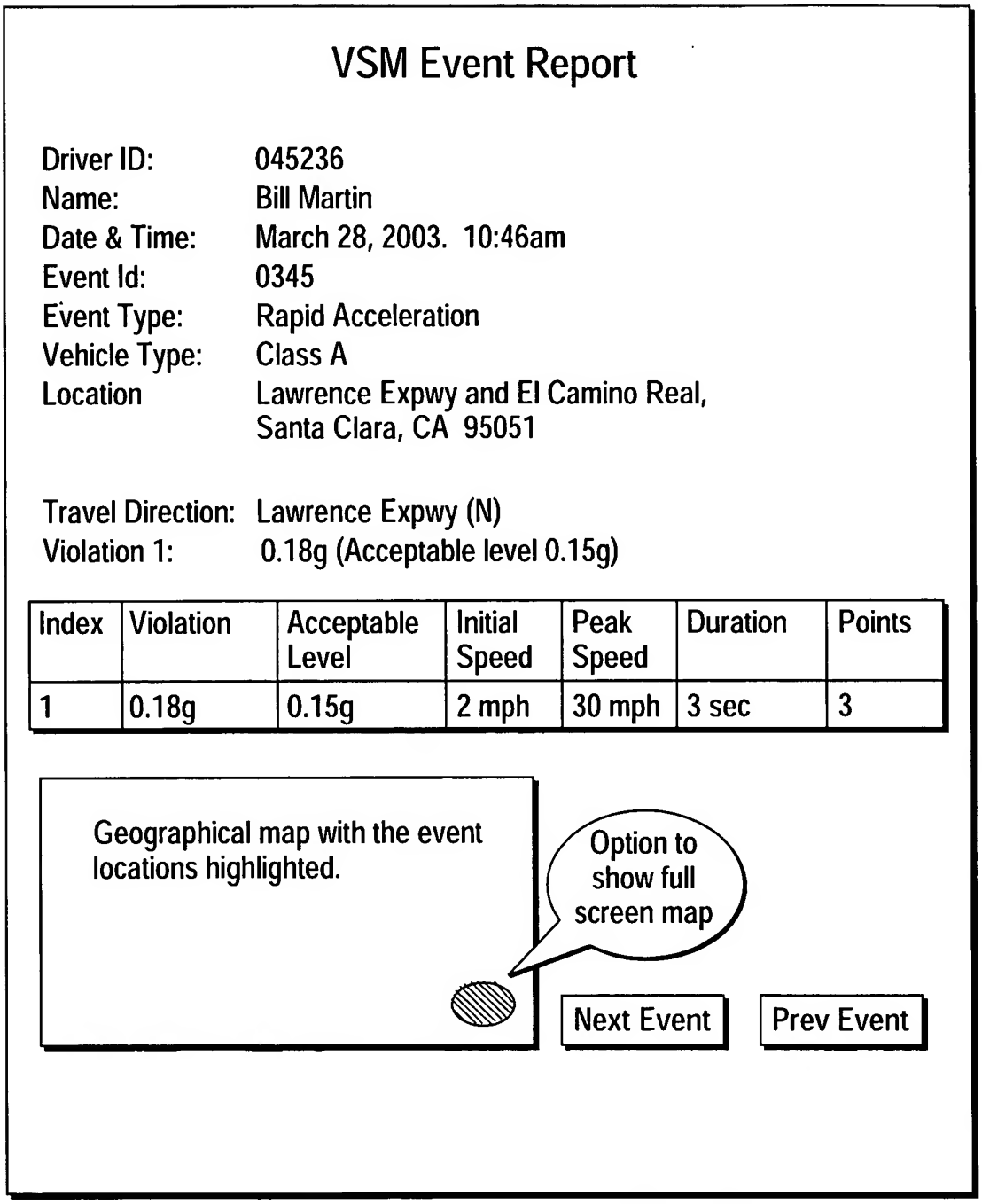

VSM Event Report
Driver ID: 045236
Name: Bill Martin
Date & Time: March 28, 2003. 10:46am
Event Id: 0345
Event Type: Rapid Acceleration
Vehicle Type: Class A
Location Lawrence Expwy and El Camino Real, Santa Clara, CA 95051
Travel Direction: Lawrence Expwy (N)
Violation 1: 0.18g (Acceptable level 0.15g)
Index | Violation | Acceptable Level | Initial Speed | Peak Speed | Duration | Points
1 | 0.18g | 0.15g | 2 mph | 30 mph | 3 sec | 3
Geographical map with the event locations highlighted.
Option to show full screen map
Next Event
Prev Event

FIG. 29

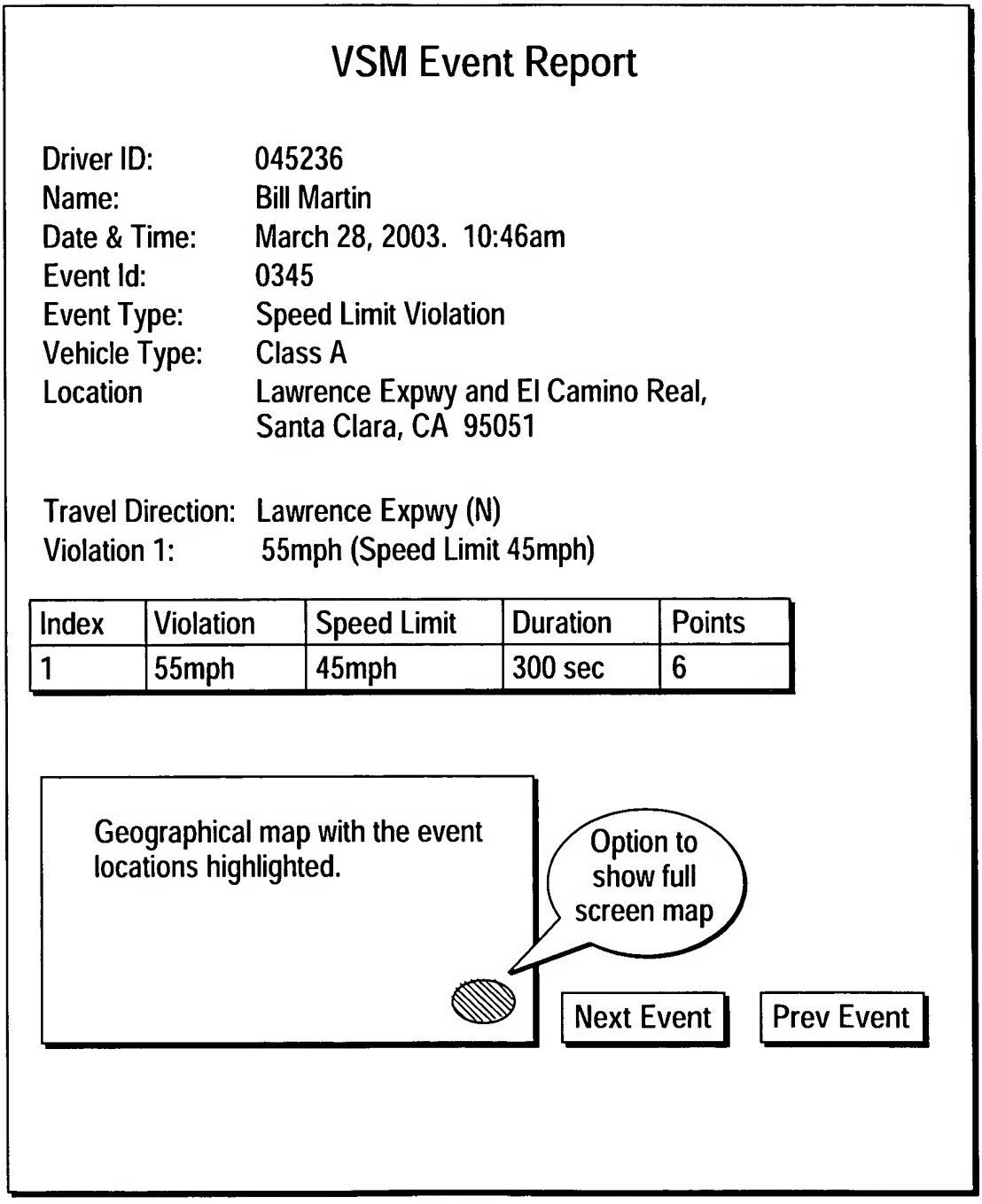

VSM Event Report
Driver ID: 045236
Name: Bill Martin
Date & Time: March 28, 2003. 10:46am
Event Id: 0345
Event Type: Speed Limit Violation
Vehicle Type: Class A
Location Lawrence Expwy and El Camino Real, Santa Clara, CA 95051
Travel Direction: Lawrence Expwy (N)
Violation 1: 55mph (Speed Limit 45mph)
Index | Violation | Speed Limit | Duration | Points
1 | 55mph | 45mph | 300 sec | 6
Geographical map with the event locations highlighted.
Option to show full screen map
Next Event
Prev Event

FIG. 30

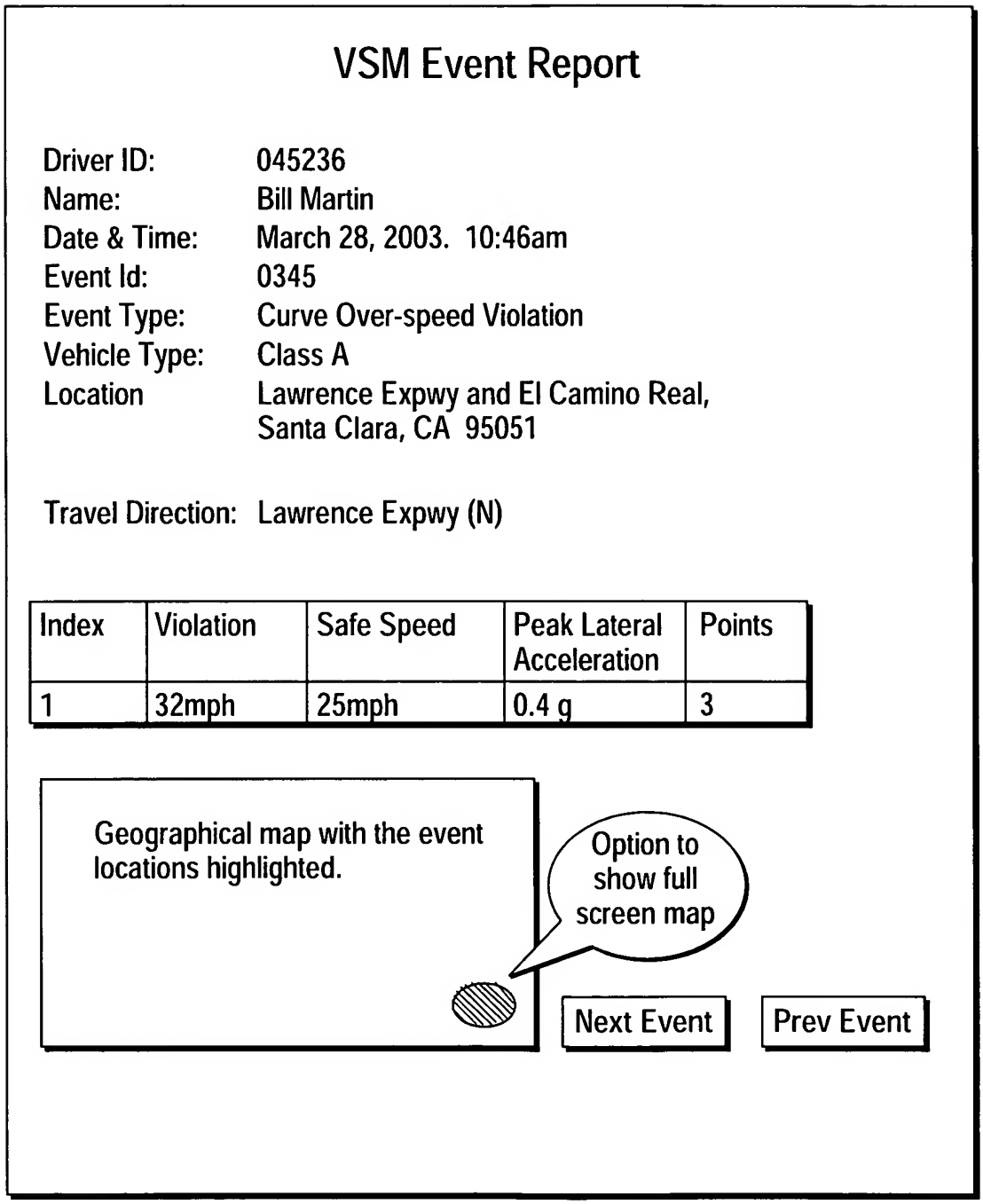

VSM Event Report
Driver ID: 045236
Name: Bill Martin
Date & Time: March 28, 2003. 10:46am
Event Id: 0345
Event Type: Curve Over-speed Violation
Vehicle Type: Class A
Location Lawrence Expwy and El Camino Real, Santa Clara, CA 95051
Travel Direction: Lawrence Expwy (N)
Index
Violation
Safe Speed
Peak Lateral Acceleration
Points
1
32mph
25mph
0.4 g
3
Geographical map with the event locations highlighted.
Option to show full screen map
Next Event
Prev Event

FIG. 31

Daily Exception Report

Fleet: Fleet_Name
Date: 10/01/2004
Time: 6:00am to 11:30pm

Driver	RA	RS	OS	TG	CS	FLC	Total Points
James	14	19	12	0	9	2	60
Miller	9	6	1	2	4	2	55
Mason	7	0	4	0	2	9	48
David	22	1	0	2	0	5	39
Mike	7	9	12	7	16	4	69
Ross	12	11	7	21	8	22	98
Kelly	7	3	12	9	2	0	12
Das	8	21	17	9	0	11	34
Sam	31	18	24	0	2	4	66
Susan	5	3	9	12	8	19	32

FIG. 32

Individual Driver Safety Trend

Fleet: Fleet_Name
Driver: Bill Martin
Period: Jan 2002 to Jun 2002, Monthly

Period	OS	TG	CS	FL	RA	RS	Total
Jan	40	22	12	30	56	48	208
Feb	32	28	6	24	45	34	169
Mar	12	4	2	12	32	24	86
April	6	2	4	15	24	14	65
May	12	3	4	8	26	24	77
Jun	7	2	3	12	22	18	64

OS: Over Speed, TG: Tailgate, CS: Curve negotiating Speed,
FL: Frequent Lane change, RA: Rapid Acceleration, RS: Rapid Stops

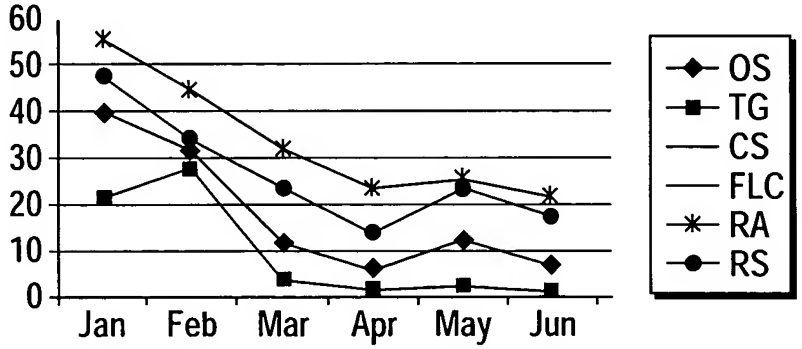


FIG. 33

Driver's Daily Event Report

Fleet: Bill Martin
Driver ID: 045236
Name: James Ortiz
Period: 10/01/2002

Event Number	Event Type	Location	Violation	Score
345	RA	Lawrence Exp X El Camino towards Lawrence Exp North	0 mph-60 mph in 30 sec instead of 75 sec	8
456	OS	San Tomas X El Camino towards San Tomas South	5 mph over 40 mph for 45 seconds	5
466	TG	Main Street towards North	2 miles	6
523	RS	101 near Dumbarton bridge, Mountain View towards 101 South	45 mph-15 mph in 4 seconds	6

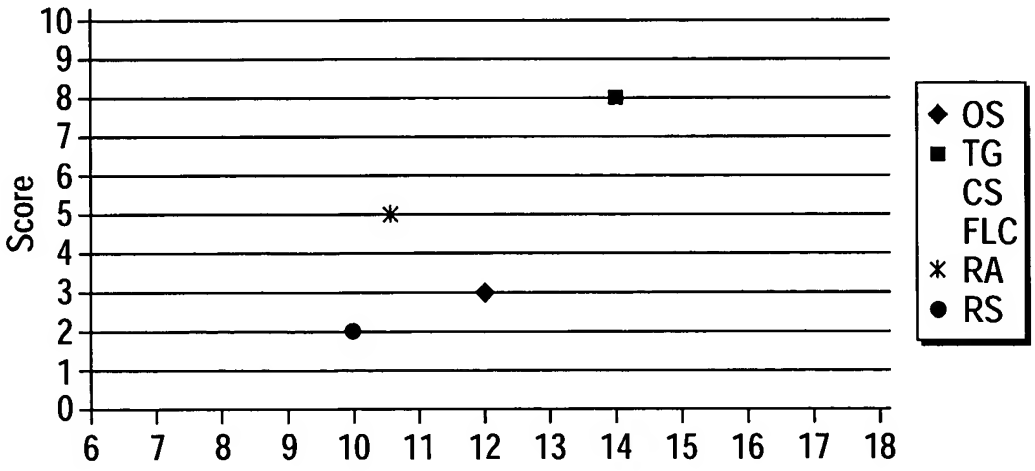


FIG. 34